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# School Teaching and School Reform





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*A Course of Four Lectures on School Curricula and  
Methods, delivered to Secondary Teachers and  
Teachers in Training at Birmingham  
during February 1905*

By

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“The result of handing over education to the most comprehensive theorist, with whatever gifts of lucid expression, would be, I doubt not, disastrous. The history of education is the battle-ground and burial-ground of impracticable theories : and one who studies it is soon taught to abate his constructive self-confidence, and to endeavour humbly to learn the lessons and harmonise the results of experience. . . .

“It not unfrequently happens—and perhaps it is not surprising—that even successful schoolmasters, immersed in the business of their profession, are found to have learned the theory of what they are doing casually and long ago from other men, and to have let it remain in their minds in undigested fragments, not really brought to the test of, and therefore not modified by, experience.”      HENRY SIDGWICK.



## Preface

THE origin of the following Lectures was a request from our Professor of Education that I should take part in a course of Lectures on Teaching which he was arranging with several Professors to deliver to Secondary Teachers in Training. On condition that my lectures were thrown open to teachers in general, I consented; though I was well aware that I necessarily regard the matter from the University point of view, and have not that intimate acquaintance with school work which would justify my entering into details in any dogmatic spirit. Sometimes, however, suggestions from an outsider are useful; and the number of distinguished teachers who attended showed

that they were welcome. It was in full recognition of the truth of both portions of that utterance of Professor Henry Sidgwick which I prefix to this book as a motto that I undertook the task.

An excuse and warrant for my interference, if so it be regarded, is contained in a Presidential Address and Official Circular issued by the Royal Society, here partially reprinted as an Appendix, to which I wish specially to direct attention.

OLIVER LODGE.

UNIVERSITY OF BIRMINGHAM,  
*March 1905.*

## LECTURE I

### CURRICULA AND METHODS

THERE are two burning questions in the air at the present time concerning English Schools. One is as to the curriculum : what subjects should be selected for teaching ; the other is as to the method : how they ought to be taught.

These two questions are closely related, and are constantly tending to merge into one another : so that, for instance, those who oppose the compulsory retention of classics often express themselves as satisfied with them as subjects, if only they were properly taught so that they might become really known by the majority of pupils ; while others advocate the retention of these languages as the staple item in a school



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curriculum because, of the whole range of knowledge, they are the only subjects which the masters by generations of hereditary practice know how to teach, the only subjects for which appropriate text-books and sound pedagogic tradition exist. So it is said.

The obvious contention of reformers is that, in spite of all this, the majority of the boys upon whom this traditional battery of education has been expended leave school full of indifference to Greek and Latin literature, with the merest smattering of the language, which they speedily manage to forget, and sometimes with an active dislike for all studies that ever formed part of their school course. To which the traditional reply is, that the object of education is not to impart knowledge of a subject, but to train the mind, to render it elastic and subtle and adaptable, and to enable its cultured possessor to hold his own among similarly educated men.

This reply, at least on its positive side,

involves an excellent major premiss ; but the corresponding minor premiss is weak, and a fallacy lurks in the negative clause of the reply.

As thus :—

The major premiss would run something like this :—Education should train the mind and character, should render the mental faculties elastic, subtle, quick, adaptable, and should result in culture.

By all means ; we can all agree to that. But the minor premiss of the argument continues thus :—Greek and Latin, especially Greek and Latin grammar, constitute the best instrument for training the mind and developing all the faculties. Therefore, of course, Greek and Latin grammar should be the staple of sound education for everybody above the rank of handicraft worker.

The extra inducement, that grounding in the traditional subjects will enable the pupil hereafter to hold his own among similarly educated persons, is forcible enough, but in essence this assertion is not confined to any

particular branch of knowledge: it 'would hold equally well of any subject whatever, *if* only it were universally recognised and of long standing. The implied condition, however, is the undoubted truth that at present nearly all our own so-called educated seniors have been taught in this way, and in these subjects, and so we must follow in the same track in order to hold our own with them, —a temporary circumstance which illustrates the usual difficulty and hardship experienced during periods of transition.

But what is the fallacy which I said lurked in the negative clause of the argument?

Its full statement ran thus:—The object of education is not to impart knowledge of a subject, but to train the mind, etc.; and the fallacy is the tacit assumption that there is some necessary opposition between knowledge of a pleasant or useful subject and a perfectly trained mind, between a subject worth knowing and a disciplinary or re-creative subject, between exercise in gym-

nasium, on the one hand, and exercise in garden or workshop or playing-field, on the other.

I will go further and say, that unless the result of education is to make at least some one subject thoroughly liked, and even thoroughly known up to the limits of the student's capacity and opportunity, it is quite impossible that his mind can be really trained, or alert, or elastic, or can acquire any other of the desirable adjectives one would gladly apply to it. It must have not only a deadening intellectual influence, but even to some extent a deteriorating moral influence, to work for a long time at a thing and then not know it. If, in exceptional cases, agility results from the training, then it is dangerous. I suggest that we ought to regard any education which results in alertness and ability combined with ignorance, from the same sort of point of view as that from which Plato regarded the lower kinds of Sophists and Rhetoricians. He appears to suggest, though

probably it was only true in extreme cases, that they had learnt eloquence, they had acquired the gift of persuading the multitude, they foisted themselves into public or private offices as leaders of men, and became rulers and advisers of the State ; and yet of all real facts they were ignorant, and thought no shame of being so, regarding the details of accurate knowledge as beneath them. So long as they could speak well and persuade, they, or at any rate the class he was denouncing, paid little attention to the truth or wisdom of the doctrines they were sustaining. Agile guides they were, but they knew not the path ; pilots familiar with the traditional methods of navigation, but without a chart ; unwilling even to trouble about the destination of the vessel, their skilful leadership might speedily lead to destruction.

Very well then, of all the things I have to say I am surer of none than of this : that no method of teaching can possibly be good which does not result in a knowledge of the

subject, proportional to the time and attention bestowed upon it.

A training of the mind by means which pretend to teach a subject and do not teach it, the expenditure of the precious time of youth on the laborious digging and weeding of soil in which nothing is to be grown and from which no fruit is expected, is not only a waste, it is a crime ; and it is apt to result in a lifetime of inefficient and unproductive activity, expended in unprofitable and misleading directions ; with no hope of any outcome, and with no open-eyed insight into the possibilities of growth and progress in the world.

Men so trained never are the real teachers of any progressive race. Real progress must go on in spite of them, and in opposition to them, conducted by men trained in other fields and outside the schools ; but that such men should be even the titular leaders and aristocracy of any race, constitutes a real danger and a risk of decadence which other nations will not be slow to perceive.

So far I have been 'treating' of 'general' principles, and so far I may in 'the main expect agreement ; but if I go further and assert that 'the average schoolboy of to-day is ignorant, that he does not really know the subjects which he has been taught, that he spends years at Latin without being able to use Latin freely, that he learns what he calls French or German and is tongue-tied when he finds himself abroad, that he drones and re-drones over a few books, sometimes over only one book, of Euclid, and is utterly ignorant of geometry,—I shall be saying what I think, but what I am not able to be sure of to the full extent. On this everyone can judge for themselves, and probably it is rash to generalise too freely.

Nevertheless, if such an accusation has any truth behind it at all,—and if it had none it would not be painful or possess any sting,—the element of truth in it constitutes a severe indictment against the intellectual atmosphere and teaching-methods in orthodox schools, even against those ancient traditions and

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time-honoured methods by which the classical languages are imparted ; although they are not now imparted as they used to be imparted—solely at the point of the cane ; an educational weapon, by the way, for which strong conservative support is occasionally forthcoming to this day.

Where lies the fault ? And one answer is prompt :—with the boys. The eager and inquiring child has by some process been turned, or has turned himself, into the intellectually dull, apathetic, indolent, professional schoolboy.

I recognise the breed, and the hopelessness of getting any knowledge into the worst specimens of the class ; but I am constrained to ask, How did it originate ? And if the answer is, apathy and luxury in over-wealthy homes, knowledge that living does not depend upon exertion—a curse to any individual and any nation of which it is true,—I must admit a certain truth in that reply. Each generation re-acts on the succeeding ; and if the present generation is



villainously educated, the next succeeding generation is apt to suffer by influence and example, even if not by precept.

But schools are designed in order to curb and replace the evil influences of home, and it is never well to assume without proof that a fault is wholly on one side. Moreover, experience tends to show, I believe, that, on the average, the intellectual apathy of boys at a day-school, who share to some extent the life of the home, is not so marked as is that of boys at boarding-schools, who are removed from home contamination for long periods of time altogether.

I am sure that there is a fault in the schools too, not in any particular schools, but in schools on the average, and I believe that it consists partly in the intellectual pabulum which is supplied, partly in the methods employed for supplying it.

I know that children who have been favoured with sound nursery or governess instruction, when they leave it and proceed

to school, frequently fall back in their knowledge, and lose interest in lessons. I believe that this is a common experience. They become sometimes intellectually spoiled, careless, and dissipated.

Suppose it is so, what is the cause? Is it due wholly to the supposed exigences of class-teaching, whereby but little individual attention can be given? If classes are too large, and their composition too mechanical, this is undoubtedly one reason; but there are other reasons; and the chief reasons are, in my opinion, first, want of trained organising skill in the teacher of junior classes; second, and for our present purpose especially, that subjects are not taught in order that they may be learnt, but are used mainly as a disciplinary task: so much time to be compulsorily expended on each task, whether the attention be there or not, the result being not attended to, or being left to Providence.

But now a word on this burning question of training. It must be admitted that in

secondary schools, junior teachers are not in general trained to deal with young inquiring minds ; they use methods probably in which they themselves were taught, and, save in very exceptional cases, they are unable to evolve a good system for themselves. Indeed, in many cases they are hardly free even to *attempt* to evolve such a system, they have to do what they are told ; but if they did attempt it, they would at first be conducting experiments at the expense of the children, and would be acquiring facilities which should have been acquired in the training college, or during some period of probation under supervision.

Any educated teacher can take the sixth form, by the light of nature : there is no difficulty about the highest form, nor about teaching by specialists in college,—though even there the difference between the good and the bad teacher is manifest ; but that difference is innate ; it can hardly be expected that training will do very much good to an incompetent person who has seriously

studied his subject and yet has no faculty for imparting it. His is a hopeless case, and, if very markedly bad, he had better adopt some other trade or profession ; for though the probability is that he would do poorly there also, yet he would be doing less harm than in a position which enables him to spoil the minds of generations of ingenuous youth.

A sixth-form teacher, therefore, feels no need of training ; and this is what those headmasters really mean who regard training as unnecessary, they are assuming the attitude of college professors and specialists in some subject ; indeed, some of them cover efficiently a considerable range of subjects, while others are limited, at least as regards efficiency, to a few.

It is *possible* that the motherly instinct of a lady teacher may sometimes dispense with the need of training for the care of infants and very small children. I doubt very much whether it does : I fancy that training is quite essential for the infant-

school teacher ; but however that may be, I am certain that it is necessary for the intermediate ages — the troublesome ages between, 'say, 8 and 16, more particularly between 9 and 15, still more between 10 and 14. For all these forms, training in method is absolutely essential.

It is in the early years of this period that the mischief is done. Children leave the home or the kindergarten, and enter a school, a preparatory school perhaps, a school any way with class teaching, and usually with young and untrained teachers ; they there soon acquire the fatal habit of listlessness and inattention, incipient decadence has set in, which continues to grow for a time and then to remain constant, until the ordinary bodily growth and material brain development wake some of them up again, at or about the age of 16 ; when very frequently it is supposed to be time for them to leave school altogether, having never known what a studious life is, nor experienced any of the joys of learning since their babyhood.

But the question arises : Is it the method only, or is it the subject-matter ? I reply, it is both.

For my own experience. At the age of eight I was set down to the Eton Latin Grammar, every word in Latin, and that book constituted the larger part of my mental pabulum for the next four years. The result was nauseating. And yet I know that I was keen to learn anything that was learnable. Valpy's Greek Delectus was inflicted in the same way. But though we all see the folly of an extreme case now, we fail to see the equal folly of much that still goes on. I knew that most of what I was doing was useless, I felt it as clearly as I feel it now. I am not speaking of Latin itself, nor of the Latin and Greek accident. Moreover, I recognise that translation is an excellent though severe exercise, it enlarges one's vocabulary and enables the right word to spring to the mind ; but the greater part of what was intended to be syntax was useless, for it

was learnt in a barbarous manner, with the meaning scarcely regarded. Avoidance of the cane was the only motive for learning in those few dreary years: everything was worked on the principle of repulsion instead of attraction—an expensive and ineffective variety of force. *Vis a tergo* is eminently suited to inorganic matter, it is doubtfully appropriate to the lower animals, it is insufferable applied to man. The Cossack is an adept at it.

Study should be attractive, of that I am convinced; not superficially but solidly attractive; nothing is more stimulating and essentially pleasurable than to feel that you are really making progress, and acquiring a mastery of something.

“No profit grows where is no pleasure ta'en,—  
In brief, sir, study what you most affect.”

So says Shakespeare; though a Mr Clark of Cambridge, quoted by Henry Sidgwick from *Cambridge Essays*, 1855, evidently does not agree, for in his opinion “it is a strong

recommendation to any subject to affirm that it is dry and distasteful."

If it be said, as it may with truth, that at first a child cannot tell what study likes him best, I answer that no one need expect him to, nor need he be asked. If he is asked, it will be found that the class he likes best is that which has the best teacher, and the study he hates worst is that presided over by an incompetent teacher. He does not know the reason, and charitably considers it the fault of the subject; but the subject itself has no fault, the fault lies in its presentation.

My belief is that the child, to whom everything is new, is eager to learn; and, if in health, is docile and intelligent until spoiled. Attention must, however, be secured; and when attention hopelessly wanders, the lesson must be suspended. It is useless, and may be worse than useless, to continue.

Discipline of the brain, and cultivation of the attention, are not to be secured all at once. Some persons indeed manage to pass



through life without having acquired these advantages : some indeed are so ignorant, it is amazing that they can continue to exist. Attention and concentration should be the fruit of education ; inattention is a deadly opposite. The one thing that many schools are thoroughly successful in teaching is inattention. It is a safeguard devised by youth to protect it through long hours of dreariness, to shield it from unprofitable subjects, or rather from subjects rendered unprofitable by their mode of presentation.

Books are so simple, so natural and easy to the adult. *Things* are so expensive and troublesome and unusual—indeed they are barely understood, or not at all understood, by many an untrained teacher—and yet the education of small children should be largely in things rather than in books. Books are about things, and, except as picture-books, should come later, or at least concurrently.

Language is a tool, a handy and convenient tool, and in the present half-civilised

or barely half-civilised condition of the human race, more languages than one or two must be acquired ; but they are, from one point of view, tools and instruments of communication ; they do not, from this aspect, deserve the time and attention bestowed upon them. It must not be forgotten, however, nor is it likely to be forgotten, that when really known, they are also a means of expressing thoughts and recording impressions and emotions ; they are then weapons of the highest artistic kind ; but few indeed can wield any language in this masterly way save the mother-tongue. Any civilised language, even when only moderately known, is a key to a literature, and is a useful adjunct to the traveller, a means of communication with people of training other than his own, a weapon with which he does well to be equipped on entering the world. But, for this purpose, language should be learned in the pupil's stride, not by years of painful application. In play, with picture-books, in conversation, familiarity with the colloquial

languages should be acquired—unconsciously almost, and easily, so as to reserve energy and real labour for things of reality and greater moment.

One of these things of reality is the inter-relation among languages, and the scheme on which they have been evolutionally built up; this is essentially an adult study, and accordingly the niceties of grammar and the science of philology make an interesting subject for years more nearly mature; but to foist these scientific studies upon small children is not only cruel but useless, they cannot possibly assimilate them, save as mechanical jingle and barbarism.

In so far as the necessary declensions and conjugations can be acquired as a jingle, that is very well; they are conventional, like the alphabet, and they involve no real difficulty; oddly enough, they stick in the memory fairly. But later on, at a certain age, or perhaps rather at an uncertain age, depending on the child, the scientific study

of some one language should be begun, by anyone intended to be liberally educated ; it should then be recognised as a branch of science, and not be regarded from the utilitarian or cosmopolitan point of view. It would certainly appear that for this purpose the fully inflected ancient languages are best and most satisfactory ; if they were still more complete and regular, like “ Esperanto,” they would be better still to begin with ; the irregularities greatly increase the difficulty, which otherwise is not great, though no doubt they also increase the historical and philological interest for adults.

A language which forms its cases and tenses by auxiliaries and prepositions is probably not so instructive as one that retains its inflexions—though I am not at all sure of that ; however that may be, it is to be expected that gradually some idea of what a language is, and why all the cases and tenses are necessary and useful, will begin to dawn upon the mind of a youth,

but it cannot possibly dawn upon the mind of a small child.

“The advantage that young children have over even young men in catching a spoken language has led some to infer that they have an equal superiority in learning to read a language that they do not hear spoken ; an inference which, I think,” says Professor Henry Sidgwick, “is contrary to experience.”

I have been much struck with the way in which Latin is learnt and used at the Roman Catholic College of Oscott. There, Latin is to a great extent the language of daily life ; lectures are often delivered in it, and much reading is performed in that language. Hence it is necessary that freshmen shall rapidly get to know it, and they do ; no matter though they know little when they come, they soon pick it up by this colloquial treatment ; and thereafter the cosmopolitanism of the Church must be greatly aided by the power of its more educated priests in all countries to com-

municate with each other. It is an excellent example of a language which is learnt for real use, and not merely as a means of discipline. It is impossible to allow years of fruitless study to be spent on a thing which is required for use : an inkling of it is obtained at once, and a polish, of various grades, is put on later. *That is typical and characteristic of the way in which everything should be learned that is worth learning.*

Dr. Gow urges that Latin forms a convenient first vehicle for imbibing the principles of scientific classification, a study in genera and species, a sort of early natural history, among objects of a cheap and easily accessible character, *i.e.* among words ; and doubtless he is right, though the objection is that a boy finds everything recorded in grammars and dictionaries, so that he gets to lean too much upon authority, and acquires too much the impression that everything is well known, that all knowledge is old and stale : which is absurdly false.

Birds, beasts, and fishes, if they were available, would be far more interesting to most youths than "words," but their scientific analysis is too difficult, and they themselves are too inaccessible and expensive for exact study at school stage. Hence the genera and species of words may be utilised instead, and the earliest introduction to scientific study, of the less strenuously-reasoning natural-history kind, may be through the medium of a language. French seems to me to have lost too much grammar to make it suitable for the purpose in its lower stage, and its significant refinements make it in its higher stages too difficult: it is a language which should be learnt for its usefulness and its delicate aroma, rather than scrutinised scientifically. Whether German may be used as a sufficiently scientific language, instead of Latin, is a question that may be debated by experts. If it were so I should rejoice, as tending to a possible simplification in curricula, and towards combining gymnastic exercise with useful acquisition; but

I myself greatly doubt it, and feel that a Romance language, with elements in many respects more different from our own, is more of a stringent educational weapon for English youth.

At the same time, this may be a counsel of perfection : the stress of subjects is severe for lads of ordinary capacity, and something short of the best may have to be put up with by the ordinary mortal, training himself for the business of life, even under ideal conditions : how much more under our present conditions.

There is no doubt that Latin and Greek took their prominent place in school education because in the Middle Ages they constituted the channels to knowledge,—a view of them which is certainly now antiquated. We live in the backwash of the enthusiasm of the Renaissance, and it no longer behoves us to pass all our youth beneath the Caudine Fork of classical studies, notwithstanding their extreme interest and value to the few called to be scholars. The bulk of mankind



will always be imperfectly educated ; and it becomes a practical question whether a speaking familiarity with several languages, and a sound knowledge of the inflexions of, say, German, is not as much linguistic training as the average boy can spare time for.

Would that he had as much as this at present ; especially if it could be accomplished, as I believe it could, with very much less expenditure of time than that at present expended, and wasted because fruitlessly expended, on the beggarly elements of ancient literature—the deadly letter without the enlivening spirit.

All things are not possible, and achievement should be the test of what is possible. Greek or anything else might be compulsory if it could become known without disturbing the balance of knowledge and without useless strain. Even so, it might be argued, should a practical acquaintance with every instrument in an orchestra, and skill in reading every kind of score, be part of a youth's instruction in music. If he is going

to be a composer or a conductor, such a training, *inter alia*, would be doubtless good ; but then in that case it is hardly necessary, for such a youth would have a natural aptitude for the knowledge, and would pick it up for himself. To subject every schoolboy or schoolgirl to the early training necessary and appropriate for a Musician, would be absurd ; and no diatribe on the beauty and glory of music would justify it, nor have any point or bearing on the controversy. The beauty and glory of Music, as of Greek, are things which no one doubts.

The study of any language which remains practically unknown and useless is a waste of time. To be any good at all, it must be brought so far as to be useful. A beginning in the drudgery of grammar, followed by complete neglect, is useless, or almost useless. But this also must not be pressed too far : to the youth with exceptional parts even a smattering is of service. His general faculties will enable him to use what to a scholar may seem insignificant and worth-

less. The test of helpful learning is, Can it be used? If its possessor can use it, well and good; it is a matter of personal calibre and ability: such a youth or such a man may rightly acquire a smattering of a great variety of human knowledge, provided always that he can store it in handy niches, and get at it when occasion serves.

Passing away from languages, then, what else should be taught to ingenuous youth? I reply, things appropriate to its various ages. Not Latin grammar, nor any other systematic science, at the age of six or eight.

Observational and experimental acquaintance with the salient and everyday facts of nature; science, if it can be called science, by all means; anything tending to enlargement of conception and acquaintance with phenomena; that is, to speak theologically, with the thoughts of God as well as with the thoughts of man. These may be always made interesting, and are natural to children; their attention will not wander;

and if left to brood over and handle things, they will unconsciously acquire or absorb much which no teacher could didactically give them, and which they neither should nor can at that age express. Let them express what they can, not what half-trained (half-baked) adults think they ought to express. Their thoughts should seldom be turned into the futile and artificial direction of trying to think what the teacher is thinking of, nor of what they are wanted to say about a thing that is before their eyes. Hasty and compulsory expression is sure to be artificial and of little use. A certain amount of unsupervised soaking is more truly educative. But to this end the thing itself must be genuinely interesting, and must be there, in the flesh.

Then as to other subjects : attention can be given to drawing, painting, music, poetry, construction, dissection, map-making, star-gazing, mechanism, gardening ; above all, attention to the meaning of words, accurate use of language, and

precision of statement ; careful use of the mother - tongue, distinct speech and utterance (distinct speech is too often neglected), good reading aloud and elocution ; memory work, not only of worthy literature but of comparatively uninteresting things too, in moderation, provided they are matters of real help, and real though trivial importance, embodying genuine facts and realities ; arithmetical and geometrical puzzles and problems, to be solved by common-sense and in self-invented ways, not in accordance with a previously elaborated scheme ; everything which fosters clearness of thought, concentration of attention, skill of hand, precision of eye, and alertness of brain.

No indigestible material to be supplied to the mind. Anything of real importance, not at present assimilable, is to be committed to the verbal memory in order that the meaning may hereafter dawn. But the memory to be reserved for the useful and essential, not clogged with rubbish for

the sake of filling up hours when the teacher has other things to do.

“If a boy is to be taught things which, it is distinctly understood, are to be forgotten, the good that they do him during the time that they remain in his mind ought to be very clearly demonstrated”—(H. Sidgwick).

For the temporary memory, recapitulation of a sermon or other discourse, if the sermon were good, would be an excellent training, and greatly cultivate the habit of attention. Recital of an event, invention and narration of a story, would be an excellent safeguard against a too pragmatical adherence to facts alone.

Careful and expressive composition in English, with grammatical and literal blunders gradually eliminated, is of course of the utmost importance, though in my day there was none of it. But essay-writing about nothing in particular, or upon subjects which are, or ought to be, unknown to the youths, is a dangerous exercise, and

is apt to engender a false facility for word-spinning without any substance behind it—a facility, only useful apparently to the composers of some of those leading articles which occasionally are produced with remarkable speed by skilled writers for the ephemeral press.

The whole of the essay entitled “The Theory of Classical Education,” in Professor Sidgwick’s recent posthumous volume, called *Miscellaneous Essays and Addresses*, is extremely well worth reading, and there is only one part where I find myself disagreeing. In the midst of many wise observations on the English language, among which he says, “In order to learn to speak English with accuracy and precision, we have but one rule to follow—to pay strict attention to usage”; and where he remarks on the prevalent inattention to the study of Early English, in spite of the emphasis laid on classical etymologies,—he goes on to say that a writer is liable to fall into a different set of errors if he ever attempts, as pedants

have attempted, to make his knowledge of Latin override English usage ; as, for instance, in the case of words like, 'edify' and 'tribulation,' where modern usage should dominate and supersede mere etymology. Now, on the contrary, it is, I believe, desirable, in the back of one's mind, to remember the 'building-up' signification, and the 'sifting-of-wheat-from-chaff' signification, when choosing those words ; and not to employ them where these meanings are quite inappropriate, even in the most metaphorical sense : it is well, in fact, to get into the habit of using words with constant care and nice discrimination, as advocated by Mr Ruskin in *Sesame*, and illustrated by Milton.

As to the employment of Greek for the invention of technical terms in science, it must be considered not only trivial but somewhat barbarous ; the meaning of a technical word, moreover, constantly tends, and ought to tend, to depart from the original derivation, as discovery proceeds :



*e.g.* atom ; and many a customary name, such as 'galvanometer,' has no intelligible etymology, apart from history, at all. There are plenty of good reasons for learning Greek, but this matter of technical scientific terms is hardly one of them.

*Arithmetic and Geometry.*

I have spoken elsewhere on these subjects, so my remarks now may be brief.

I am convinced that arithmetic and geometry should first be taught, not as systematic science, but by observation and experiment : experiment with handled things, like counters or beans or coins sometimes, but experiments usually conducted on paper. This kind of experimenting is cheap and easy, and very instructive. Subjective discoveries can be made in this way, and usually excite considerable interest.

Even at a very rudimentary stage the value of six times seven should be not told but ascertained. It should be realised that all that is intended by the question is how

to group things in tens instead of in sevens. For instance, six sevens and 3 over, can also be grouped as four tens and 5 over, or as three dozen and 9 ; and

$$6 \times 7 = 42 = 3/6$$

is an abbreviation for the main part of this experience. The fact that six sevens make 42 should then be learnt mechanically for handy use hereafter.

The phrase “eight and fourpence” suggests things grouped in dozens ; if grouped in tens they make ten complete packets.

A quantity of this experimenting, enough to be useful but not enough to be wearisome, should precede the niceties of numeration, and serve as an introduction to the ingenious shorthand of the conventional Arabic notation. Adults are so used to writing four groups of ten and 2 over in the compact form 42 that they forget how much abbreviation and shorthand there is about it ; and they sometimes forget to realise that they might equally well write it 3/6, meaning three dozen and 6 over.

What is called the multiplication table, or the pence table, is simply a summary of experiments in grouping, — a trivial but handy and useful exercise.

Afterwards there should be experiment on powers and roots, and indices and logarithms, and series or progressions; and throughout plenty of exercise in amusing problems, such as are sometimes to be met with in the contemporary press.

The 'rules' should be led up to and arrived at by experience and guided experiment; and, if possible, they should be first formulated imperfectly and badly by the pupil, who will then better appreciate the more correct mode of statement subsequently imparted. To give the correct and complete at once, without opportunity for the incorrect and partial, is but half to do the business. To understand and realise the working of a rule, it is necessary also to experience the way in which it fails, or rather the slight modifications which make it fail; though it is a mistake to emphasise

the false as much as the true : the false should not be allowed a chance of dwelling in the memory.

So also in Geometry, some of the propositions, especially the constructions in Euclid (or better ones), could be invented ; and the inventional solution of a number of other simple propositions, such as are formulated as questions for small children in Spencer's *Inventional Geometry*, would give life and reality to the subject.

It is a far better training to cultivate the habit of thinking for one's self, the habit of solving any problem presented, or at any rate of trying to attack it, than to load the memory with a number of beautiful problems ingeniously worked out and formally recorded in perfect though sometimes artificial style by the ancients. The latter is a training in classics, not in geometry.

And it must be noted that a knowledge of Euclid is not complete unless the numbering of the propositions is known and the order rigorously adhered to ; otherwise the

proof is no proof, since some of the facts depended on may covertly assume the thing to be proved. Fortunately this was realised by my own teachers, and accordingly my acquaintance with the text of Euclid at one time was as complete and thorough as my acquaintance with the words of the Church Catechism.

It is the difficulty experienced by those who abandon the linear order and logical arrangement of Euclid, for some more modern and more geometrical and comprehensive and practically useful ideas, which has played temporary havoc with elementary school geometry. Like all revolutions, it necessitates turmoil and trouble for a time, but the result will, I trust, justify those who have felt constrained to advocate some departure from time-honoured and classical but inefficient procedure.

If Euclid could be *universally* learnt and enjoyed, as by some boys it can be learnt and enjoyed, as I learnt and enjoyed it myself for instance, then I for one would

advocate its retention, just as I advocate the retention of any other classical masterpiece which can give pleasure. But inasmuch as experience shows that the average boy is not competent to appreciate the beauties of Euclid, nor even to understand and assimilate the text, the persistent attempt to soak him in it for many years, till he becomes sick of the whole business, must be abandoned. That is not the way to teach real geometry : a boy must learn geometry by direct experience, and by simple reasoning based upon that experience ; and, what with geometrical drawing and experimental trigonometry and surveying, he can far outstrip his classical colleague in real and intrinsic knowledge of the subject, even of the facts incorporated in that curious and beautiful antique Euclidian structure.

He will know things in a blunt, utilitarian, practical-engineering sort of way ; his culture will be deficient, if it be limited to that mode of treatment, but his usefulness may

nevertheless be considerable ; and if he has, as he often has, ability in some other direction, he may make his mark in the world, and be a credit to his school and nation.

## LECTURE II

### CHIEFLY ON TEACHING IN HISTORY AND SCIENCE

A SPEAKING and writing acquaintance with the mother-tongue, and with the elements of at least one other language to give it life and reality,—for the man of one language, like the man of one book, can have no full conception either of language or literature—these things are inevitable in any system of education. There remains the question of indoctrination in the facts and lessons of History, and in the eternal truths of Science.

Take History first. It is clearly to be discriminated from Science, though, like everything else, it may be studied by scientific methods. It is discriminated in this definite way: it has distinct reference to



*time* ; it is a study of the past, and of the present as an outcome of the past. It is by the study of history that man is differentiated from other animals, who live only in the present. That which occurred 'before the life of the individual animal is 'non-existent, except in so far as it has left a residual influence on his instinct and bodily organism ; but to the human race the whole of racial experience, so far as it has been recorded, lies open for use, or can be dissected out by skilled explorers ; and it is this transmission from age to age of the accumulated experience of the race which, more than any other fact, has raised man above other animals and enabled a human race to exist. In language, in social institutions, in ceremonies, in Architecture, a great deal of history is imbedded, as well as in documents and inscriptions. The earth itself has a history, which is read by the historical science of Geology. Part of Astronomy is in that sense also historical. Chronology of every kind, everything relating to the

past, has a historical side. Science itself has a history, often of surpassing interest. But the laws of science proper have no reference to date; they are independent of time and place: if true, they are always true, here and everywhere. That is why it is sometimes said to deal with the eternities and the immensities. With the facts or assertions of Science, however, time and place are often involved: they contain often a geographical and historical element, as when one species is given a local habitat, and another is spoken of as extinct. Certainly this is so, and all knowledge is interlocked and welded together in this sort of way; but it must be recollected that classification is always more or less artificial, and the essential distinction between the historical aspect of knowledge and what I conceive to be the specifically scientific aspect of knowledge is clear.

It is this independence of 'time' that enables science to make predictions: the fundamental laws can be trusted in the

future as well as in the present and the past, subject always to the possibility of unlooked-for interference, or for oversight due to lack of data and human fallibility. One important lesson, imparted by real education, is that infallibility is not accessible to man. Amazing have been the blunders made by the natural tendency of the ignorant to take refuge in some kind of infallibility, to elevate into an oracular and trustworthy utterance even a casual assertion or side-reference made by a truly great man. Infallibility of this kind is sickly and infantile, and is not to be expected even from the greatest of prophets. As for scientific men, the utmost that can be expected from them is care and candour—scrupulous candour and unremitting care. If, like prophets and poets, they have the element of inspiration also, it is well; but the utterance of their moments of inspiration must be scrutinised too, and caution must be rigorously exercised both by teacher and by disciple.

What are we to say, then, about the teach-

ing of history in schools—the history of the world, of mankind in general, of one's own nation and city in particular? Usually the term 'history,' in school, is applied in the sense of the history of our own nation, beginning at some well-marked epoch, and finishing a century or two away, so that events may not become too complicated or too personal. Much of what is so taught is rather the dry bones of history; it is anatomy rather than physiology, a scrutiny of the structure of defunct organism rather than a study of living function. Part of this anatomical study is necessary, and may be acquired young. The order of the kings, for instance, with their dates, is a harmless and useful piece of memory work; it serves afterwards as a sort of framework in which to set more vital details. But for any real insight into the history and institutions of a people, in their struggles and revolts, their failures and successes, their emancipations and their oppressions, for any real sympathy with the feelings and efforts

of a statesman, something beyond infantile age is necessary ; and I doubt whether any living interest can be felt in these vividly interesting things until some idea is grasped of contemporary politics, and of the motives which sway men and nations. Politics may be called the history of the present. History may be called the politics of the past. Politics itself has, no doubt, many defects for educational purposes : one is that it moves so slowly, the dull periods take their full time as well as the exciting periods, and we get swamped with the trivial and the unimportant ; even if we are able, as usually we are not able, to take a broad disinterested view of matters under discussion, and to distinguish the permanent from the temporary. Thus, if we tried to utilise those extracts from the *Times* of last century, which are printed each day, in order to follow the course of, say, the Napoleonic troubles, we should be choked off by the slowness of their development. Napoleon has been strongly in evidence since this

century began, but we are yet a long long way, a whole school life of ten years, from the coming of the battle of Waterloo ; we cannot wait for it.

So that is one difficulty of contemporary politics ; and another is, that it partakes too much of the nature of gossip and triviality to be capable of being made a serious school subject ; and boys brought up on it would be apt to be offensive and priggish. Indeed, that is a thing against which enthusiastic educators have always to be upon their guard ; and I commend to their notice Mr Andrew Lang's excellent fairy tale called *Prince Prigio*.<sup>1</sup>

But, nevertheless, the study of history cannot come to full life until the spirit of politics—not necessarily party politics, but politics in the legitimate sense : sociology, public spirit, patriotism, civic interest—has been somehow awakened. And if this can be done by the judicious teacher in con-

<sup>1</sup> Incorporated in his *My Own Fairy Book* with two other stories.

nection with the historical events of the past, as I suppose it can, and sometimes is, no effort should be spared thus to infuse the body of history with the life-blood of humanity. It then becomes a good and stimulating subject, and leaves an effect long after its exact chronological details are forgotten. I always forget them, and am relieved to find that Creighton says it does not matter—the spirit of them remains in the mind ; and, as usual, the spirit is the vital thing. If the spirit and the atmosphere are there, the details can always be looked up when wanted ; and part of education should consist in familiarity and practice with this looking up of details, with the use of books in general, not only of books of reference. A book in its natural order is more instructive than a book in alphabetical order. The latter may be necessary for ignoramuses, but other books are usually employed for subjects which one has really studied. I am not now speaking of a collection of treatises bound together, like the *Encyclo-*

*pædia Britannica*, but rather of such a volume as the *index* to that work. Its proper use is for mainly unknown and new subjects.

Some idea should also be grasped—though probably that comes better later, at college—of the way in which documents are utilised for the ascertainment and construction of history by historians themselves. It is highly desirable that specimens of real ancient documents should be exhibited. The Oxford *Helps to the Study of the Bible* are excellent in that way, by their facsimiles of the real textual authorities, of which the familiar English version in common use is a tremendous simplification.

In any case, history is a live and human subject, and one in which it is easy for everybody to take an interest, if the teaching is only decently intelligent. When the teaching is really skilful, and appropriately intermingled with biography, it becomes a most admirable instrument of education ; interest in it may become enthusiastic. This latter



statement can be made also of nearly every branch of science ; but, alas ! it is quite easy for what is called 'science-teaching' to be dull and depressing. It is impossible for anyone to care for a record of bare fact without liveliness and without human interest. Hence school-teaching in science is, I verily believe, the most difficult of all : and the difficulty is felt with the very first branch of science attempted—the laws of number and of position, the elements of arithmetic and geometry. As frequently taught, they are generally found unpalatable, though there are many attempts at improvement to-day, and doubtless many successful teachers. I have spoken before this year on the teaching both of elementary arithmetic and of elementary geometry, so perhaps I need say very little more on these heads just now, except to recapitulate that the more pupils can be encouraged to attack *problems*, and, what is less usual, to *experiment* in principles and laws, and to find out arithmetical facts and

geometrical constructions for themselves, the better. It may seem slower, but the results are more wholesome, the mind is better trained, and the acquisition is more thorough. Time is saved in the long run.

Progress, however, should not be *too* slow. A year should be a period of conscious advance. The infinitude of learning is staring us in the face all the time, and yet something definite may be attained in a year.

Consolidation and thoroughness at the early stages may be overdone. Constant setting back for repetition becomes dreary, and, besides, it is un-economical of time and effort. Subsequent or deferred repetition of the early part, in the light of later knowledge, is far more illuminating and profitable, besides being far quicker. A hidden meaning then looms through the dull mechanical details; and the initial stages look quite different, may even look quite absorbing and lively, when

regarded with the eye of more advanced knowledge.

Teaching to others younger than ourselves is an excellent method of consolidating our knowledge of the elementary portions. And in so far as you thereby perceive difficulties to which you had previously been blind, do not be impatient, but be grateful for the help afforded by your less agile pupil.

But not all the stages through which it is the custom to force unhappy children look interesting and lively to adults. A great part of school arithmetic not only is dull to children, but it looks dull to the mathematician, and I venture to say is dull in reality. Rules like 'practice,' stocks and shares, tare and tret, and other impossible and absurd complexities of pretended commerce ; prices and amounts of commodities, expressed in the most futile units that a nation in a state of semi-barbarism has invented, have to be worked out.

Many sums in compound multiplication and division are of this character—acres,

roods, and poles ; drams, pennyweights, and scruples. Such sums are surely unknown in any actual business. They may be called concrete examples, but many of them are artificial, stupid, and depressing. A machine could be contrived to do them, but it would be useless. When things anything like them are wanted, as they may be, in some simpler form, by a housekeeper or shopkeeper perhaps, they are in practice done by tables. This sort of stuff is neither arithmetic, nor mathematics, nor common-sense ; it is an opportunity for wasting the precious learning-time of a child, and disgusting him with study. Even when he has become perfect in the mechanical grind, he has achieved nothing. He may be able to pass matriculation, or perhaps get a scholarship. I hope not, but he may. If so, his instructors have sold his learning-time, his easy-assimilation period, for fifty pounds a year for three years ; and his parents rejoice at the paltry saving of their most vulnerable spot—the pocket.

*Geography.*

As an example of a science which might be full of life, and which may be taught as a string of the baldest and crudest and dullest facts imaginable, Geography is prominent.

Suppose a boy learns geography, and gets up all the towns, bays, rivers, and inlets round the coast of Africa or South America, for instance, so that he can say them off blindfold. In two years how much of it will he remember? But if he does not remember it, where is the good of learning it? Suppose, however, that it was drummed into him so thoroughly that he did not and could not forget it, but went about, ever after, a sort of walking gazetteer of information on this series of facts: what could be the good of it? No one would appreciate it; and if he tried to show off his knowledge, he would be either set down as a prig, or set up for exhibition as a prodigy of memory.

How, then, would I have him taught geography? I would have him taught to understand maps in combination with field work; he should be able to make maps and to read maps, and this would involve acquaintance with the principles and some of the practice of surveying. He should be able to read maps in a scientific manner, so as to realise from them something of the features of the country represented.

He could not properly realise mountains without actually visiting a mountain district; but once having apprehended mountains and passes, with an intelligent eye and with exploring feet, he will be fitted to grasp something of the nature of other mountainous districts on a map, and no longer be liable to think of the Transvaal, for instance, as if it were a level plain. Nor would his education have unfitted him for the task of leading men in that fell region.

He cannot fully understand the use of a harbour or an estuary, without a visit to docks or to some other selected portion of

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the coast ; he might also see how in some places artificial breakwaters and piers are necessary in order to construct harbours ; and gradually the characteristics of every bay and inlet on the coast, whether actually seen or not, would be appreciated.

So may the influences of elevation and of aspect—of tilting to the south—be made real ; the variety of climate ; the influence of rivers, of geological formations, and of surface soil. In learning all this, and in using a globe, a general and not insignificant acquaintance with the earth's surface will be acquired ; and beyond this it will be necessary for him to use maps in conjunction with his history, to understand why certain towns have become capitals, and why other places have been regarded as the key to political situations and the kernel of wars. He must be able on a blank map, *i.e.* a map undisfigured by names, to point out and name all the more important countries, rivers, and towns ; those, namely, which every ordinary person necessarily and natur-

ally knows ; not those which can only be retained by artificial effort, and which are just as well forgotten.

For the rest, for all minutiae, and for refreshing his memory, he must be content hereafter with the possession of an atlas, which he may take a pleasure in consulting ; together with guide-books, which are often the best treatises on geography ; and on the gradual opportunity afforded by travel, for becoming acquainted, not with the mere dry names of important and interesting places, but with their full-bodied life ; and he may ultimately learn to feel something of the vivid interest and real affection which places themselves are often capable of inspiring.

If geography were taught in this way it would not be dull nor depressing, and it would provide an outline capable of being filled up in detail to unlimited extent in the future. For when I deprecate the learning of out-of-the-way places, in order to be able to say them five minutes later and then



forget them, I did not intend to imply that a professed geographer would not know these places. Such an one will know these and vastly more ; but we are not legislating for professed geographers, or for men of any special learning, but for the education of the average homely citizen, setting forth on his life journey to do his share of the work of the world. The great thing is to leave him elasticity and capacity and youth, to show him the way to learn, and to give him a liking for learning. To let him feel that it is a privilege and an excitement for which life is all too short ; to feel not that he has already learnt and has gladly forgotten, but to feel that he has *not* learnt ; that he has been taken only to the brink of the promised land, and been shown only a sample of its fruit, but that henceforth its whole wealth and beauty and variety lie open to his investigation.

What I have said of this subject, chosen at random, is to be taken as a parable, and it can be applied all round.

Sometimes we are told that geography should be taught as a branch of history, or along with history. This sounds plausible ; but, as Mr Mackinder has recently said, although geography and history are sisters, there is no necessity to imagine them Siamese twins. If geography is only taught with history, and by the historian, it will, as a rule, be not properly taught at all. Some geography should be taught in this way. To teach history without any geography and without reference to maps—as indeed it used to be taught—is absurd. But just as there is any quantity of history—Institutions, Parliamentary struggles, and the like—which are independent of geography, so there is plenty of geography which is independent of history. Teach them separately, therefore, and likewise teach them together. Utilise broad geographical knowledge and aptitude, in teaching or studying history, and supplement it in details as required. History enlivens and illuminates the study ; and a recapitulation of towns in which

nothing has happened, and with which no events of interest are associated, is stupid and dull.

Sometimes the history dominates the geography ; as is obvious when pronouncing the names Athens, Syracuse, Rome. Sometimes the geography dominates the history ; as in the Himalayas, the Alps, the Mississippi, the Congo. Sometimes the two go hand in hand ; as in Constantinople, Venice, the Nile. Discrimination and common-sense surround both subjects, and there is no need either for artificial separation or for hampering union.

### *Physics.*

Well, now, take another science ; take Physics. Should that be learnt at school ? And if so, how ? Some subjects, if they are learned for examination, are spoiled. Mechanics may be learnt for examination ; or, rather, it is a subject on which examination may be easily and properly conducted, for it is a science of simple laws and

principles, of a very fundamental character, obtaining among phenomena with which everyone is of necessity partly acquainted—motion, force, equilibrium, speed, acceleration, momentum, energy, and the rest. It is a unification and systematisation of what else would be discarded—fragments of common experience. It is a training in the accurate use of common terms, and the association with them of definite and quantitative ideas. It is a most valuable and illuminating study, and lies at the basis of all physical science ; it is also the simplest illustration of applied mathematics, that is to say, of algebra and geometry and trigonometry, even in its early stages, and of more advanced mathematics in its higher stages.

Its illustrations are drawn from levers and cranes, and screw-presses and pulleys, and ladders and cricket balls, and railway trains and lifts, and pumps and rifle bullets, and falling stones and catapults, and such-like. It is the earliest part of the foundation of physics, and, as far as systematic

study is concerned, it should precede physics ; but it would be a mistake to defer other parts of physics until elementary mechanics was mastered.

Other parts of physics 'should be introduced simultaneously, but in a different way. Some of these parts also deal with phenomena which by habit have become fairly familiar, such as heat and light ; portions of these may therefore be dealt with quantitatively, and therefore may be examined upon. But the facts themselves are not very familiar, and a qualitative study of them should be encouraged before measurement is undertaken. Thus the properties of prisms and lenses, and telescopes and microscopes, should be known by direct experience before they are dissected and treated accurately. It should not be supposed that these things are simple and easy to children, but they are interesting, and are felt to be worth understanding, unless, by premature worry about them, they are allowed to become repugnant.

So also in Heat ; the phenomena of heat and cold, and boiling and freezing, can be observed even before a thermometer is used, but some quantitative experiments are badly needed to enliven and illuminate these otherwise rather puzzling changes. They are not in themselves so entertaining as are some of the effects of light. Combustion is lively enough, no doubt, but that is properly a branch of chemistry.

Heat is the part of physics in which measurements should first be made ; and subsequently Light should be attempted.

But there are other parts of Physics in which at early school-age much quantitative measurement is hardly feasible or desirable, and on which examination at any rate is premature. These lie chiefly in the large domain of Electricity and Magnetism. Here the phenomena themselves are unfamiliar, and the first thing is to let the pupil get acquainted with the facts by soaking them in, unassisted so far as may be.

He can be encouraged to make an electro-magnet, an electric bell, a battery, a galvanometer, even an electric machine of some kind. He can amuse himself with sticks of sealing-wax, Leyden jars, and other toys, and can find out facts as far as possible for himself. This sort of work is appropriate for home and for leisure hours; it is in the same sort of position as the carpenter's shop and the lathe, before serious work is attempted.

Working at these things for examination would spoil them, but the construction of an induction coil and other instruments will keep his thoughts dwelling on the subject in an instructive manner, and will probably lead him to read about the things in cyclopædias and stray books of an elementary character, such as some *Boys' Own Book*, or *Pepper's Cyclopædic Science Simplified*.

All this is not science, but it is a preparation of the mind for science on one side: that is to say, an initiation into and familiarisation with phenomena. The

other side of the preparation is afforded by the drill in mathematics and mechanics, and other exact and suitable subjects, including the accurate use of language and the power of clear expression, such as could be fostered by the keeping of careful notebooks, or even by writing to the correspondence columns of *The English Mechanic*—which has been an educative organ to many.

Throughout, it is desirable to intermingle with the facts of science some human interest, to give it partly in the nascent stage, to trace the steps of discovery, to point out what was thought at one time, and how it was gradually corrected, and to elicit admiration for the Pioneers of science. The early ideas of men of the past are sure to be something like the early ideas of the child of to-day, and it will feel more at home with them than with the most recent views. *The steps of evolution should be borne in mind* by the organising teacher, and the stages of discovery may be to some extent, though rapidly and judiciously, followed.



*Awakening of Interest.*

There are two ways of beginning a subject. One is to begin at the logical beginning. To begin geometry by a disquisition on the point: to begin physics with the laws of motion: to begin music with the scales, etc. etc. The other way is to immerse the pupil in the higher and more enjoyable reaches, so as to excite his interest and stimulate his ardour. Before he knows anything of music he may go to concerts; before he knows anything of physics he may dabble in experimental electricity or magnetism; before he knows any geometry he may be interested in figures and constructions and puzzles.

*Every subject should be begun both ways; and the interest should be awakened first, in my judgment, before the administration of details, which may be indigestible until the appetite has been stimulated.*

For instance, Botany and Zoology. The scientific beginnings may possibly be dull,

but interest in plants and animals is easy to awaken. The books of Miss Arabella Buckley<sup>1</sup> should be most useful towards that end. Direct and unaided observation is too difficult unless greatly supplemented.

The beginnings of Greek language may be hard, and apparently have to be made compulsory lest it die out ; but if schools aroused an interest in Greek literature and history, and made boys realise the survival of the Greek spirit and the part it plays in the world, a percentage of them would willingly go through the drudgery of acquiring a fair acquaintance with the language, and a few of them might even go on to become creditable Scholars in due course.

Remember the extraordinary spirit of civic enterprise and patriotism which was alive in ancient Greece, so that men would not only work and live for a City, as now, but would fight and die for it ; a spirit

<sup>1</sup> *Life and Her Children*, and *Winners in Life's Race*, by Mrs Fisher, née Buckley, are excellent and trustworthy and well-known little treatises.

which Mr Chesterton tries to awaken in his farcical but really serious legend called *A Napoleon of Notting Hill*.

Stimulate interest and enthusiasm, and study is bound to follow. Acquaintance with Greek literature and history would be far better, as a "little-go" subject, than a Greek text got up with a crib. Whatever may be the case with Greek, I am sure that stimulation of interest in steam-engines and stars is the best way of beginning Physics.

I would far rather teach physics to a boy well grounded in mathematics, who had only dabbled in experiments at home for love of them, than to one who had been put through a severe metrical drill, and been taught to measure and accurately observe all sorts of things in which he took no interest.

I do not care to teach a youth how to measure things which in themselves he cares nothing about. Sometimes the training in a physical laboratory, designed by one who has the instincts of a physicist, is too refined

and intricate for the uncultivated taste of the average youth. I have put a number through such a course myself, but it is dreary work ; and only a small percentage seemed to reap any benefit. Nearly all were glad when the hour or two hours' spell was over.

I doubt if that sort of thing is much use, except for passing examinations. It may be regarded as discipline, but the subject is hardly a good disciplinary subject. People who have to be spoon-fed and assisted over all their difficulties are not going to make much out of the study of physics ; and unless the early training can be made very different from what it now is, and youths' minds made much more receptive, I am not over-sanguine concerning general physics as a school examination subject.

But this raises the question whether there are not other subjects for which the same sort of feeling may exist. I believe there are, and that Literature is one of them. Speaking with all deference, I rather despair

of literature as an examination <sup>9</sup>subject. Language can be examined in, because it is definite, in many cases definitely right or definitely wrong ; it is a matter of usage, no doubt, but hardly a matter of taste, except at a higher grade ; but literature, even the elements of literature, seems to me to involve a kind of spirit, to be a Pegasus which it is impossible with any satisfaction to harness. It is a thing to be enjoyed, to be immersed in, to catch the flavour of, but not to answer questions on. Composition—yes ; but that is part of language. By study style can certainly be improved, but the higher graces of style it is hardly possible artificially to cultivate : clearness of thought and expression, accuracy in the use of words, all *that* can be fairly taught ; but style surely is a gradual growth, and should be an evolution from the individual character ; it can hardly be received from another, save as imitation. Imitation at some stages doubtless occurs, but I think it should only occur unconsciously, except

for purposes of parody. The writing of good English is an Art, and instruction in it is like instruction in an art. Drawing must be exact, the playing of music must be correct; technique can be taught, but the Inspiration and Soul are things which cannot be imparted: they come we know not how: they cannot be commanded, nor can their source be traced.

*Study to a Useful Stage.*

There is one more general utterance which I want to make, in amplification of a dictum of mine which I find occasionally quoted, sometimes with approval, sometimes with disagreement: it is, that whatever study is entered upon should be carried to a useful stage, should be studied up to a useful point before dropping it. Such a dictum, if it is to be of any service, must be interpreted with discrimination; and the whole bearing of it is rendered nugatory, and even objectionable, if the term 'useful' is misconceived. I suppose there is hardly any

adjective in the English language which suffers from so much mis-use as does that word 'useful'; so that occasionally some rebellious and paradoxical Irishman contends seriously that Universities exist for the propagation of 'useless' learning; 'a phrase intended to arouse thought, but liable only to excite ridicule.

Let me explain, then, that I do not employ the term 'useful' in the sense of utilitarian. I do not mean that it will increase anyone's income, nor even the amount of bread and butter in the world. The increase of a person's income may be a doubtful boon; and many most undesirable accomplishments, of which burglary is one, Monte Carlo another, and Company-promoting said to be another, may have that result as a possible end; at any rate it may constitute an entirely soul-absorbing aim, for the attainment of which, life, in the sense of fulness of existence, is willingly lost. Some people's idea of what is useful is limited to that for which they are willing

to sell themselves. Perhaps, after all, they are not paying an excessive price.

I do not mean anything so violent as that ; I mean by 'useful,' simply something that can be used, something that is either a service or a joy to its possessor and to those for whom he cares or whom he desires to benefit.

For instance, piano or violin playing—on what condition should either of these be begun ? The condition surely that pleasure, and not pain, should be the result. There may be failure ; but if one could be sure that the pain caused by the beginner would be perpetual, it could not be considered worth while, and the study would not be begun. But to suppose that in order to make it 'useful' a study must be carried to such a pitch that a professional living can be made by it, is absurd ; the misuse of the term is obvious.

Very well then, in every subject there are stages at which a certain grade of usefulness has been attained, sometimes a very low



grade, sometimes a higher grade, but a grade at which *some* definite benefit can be felt from having given time and attention to the study. In a modern language, for instance, the first grade is attained when one can ask one's way about the country and get on sufficiently well in railways and restaurants ; a second grade is attained when books in that language can be read with fair ease ; a third grade when conversation can be freely carried on with educated persons ; a fourth grade when the language is really known so that it can be used for literary purposes ; and a fifth grade when genuine scholarship is reached.

Any of these grades of accomplishment are worth attaining, but in between some of them there is a considerable interval, at which there is nothing to hook our attainments on to ; they cannot in the intervening stages be 'fixed,' so to speak ; so that lapse and forgetfulness are likely speedily to ensue unless one or more of these several stages is reached.

Take Greek as a further example ; for there it so happens that even an absurdly low stage is useful.

The first stage is the mere knowledge of the alphabet — it is useful in mathematics and physics. It is a perfect nuisance, when lecturing at a technical school or such place, to suddenly realise that a trumpery letter like  $\pi$  or  $\phi$  or  $\epsilon$  sounds hard and attracts the thoughts of the class.

The second stage of usefulness in Greek is when an inscription or motto can be puzzled out by the help of *Liddell and Scott*.

The third stage is when the New Testament or other easy text can be read with fair intelligibility and ease.

The fourth stage when classical authors give pleasure.

The fifth and higher stages proceed up through all the grades of scholarship, about which, of course, I am quite incompetent to speak, or very likely even to imagine.

So it is, at any rate, in Mathematics. The

first grade of usefulness there, is, I suppose, being able to add and subtract figures correctly and quickly, like a bank clerk.

The second grade is being able to amuse one's self by solving little problems and puzzles, and being able to work such things out, in general and intelligent form, by help of algebra.

A third stage is reached when ordinary formulæ, employed in elementary text-books or blackboard lectures on science, need not be shied at nor skipped.

A fourth, when ordinary treatises on physics can be read without insuperable difficulty, even though differential and integral methods are freely employed.

A fifth stage when mathematics becomes itself a tool or instrument of investigation, so that discoveries can be made by its aid.

A sixth stage when the highest branches of mathematics are reached, and progress in the science itself can be appreciated and assimilated, and its boundaries advanced by discovery.

And a seventh stage—the stage of creating new regions of mathematics, the stage of special mathematical genius — up to Cayley, Lagrange, and Newton.

Now, in all these cases I would suggest to the teacher that he may do well to keep these, or similarly formulated aims, before his mind, and see that without undue delay they, or something like them, be attained, one after the other. It is miserable to keep laying a sort of foundation for the highest, and after years of laborious grind to have attained nothing particular. If the pupil is able to feel that he is attaining something, he is encouraged, and can then go forward in faith and energy on his further quest.

### LECTURE III, SECONDARY SCHOOL REFORM IN GENERAL

So far, we have dealt chiefly with range of subject and with methods of teaching, endeavouring to indicate places where improvement is possible ; but now we come to more general topics, and deal with the possibilities of school reform in general.

First, a few words on the examination bugbear. I must recapitulate first a few old stock statements which, though hackneyed, I regard as certainly true.

External examinations, which have specially to be prepared for, are hampering to the teacher. They tend to keep his attention directed to some artificial end, and to the mind and will of another, rather than to

the immediate object of his work—namely, the drawing out and development of the minds committed to his care.

If the stimulus to learning could be contained in the subjects themselves, without adventitious and competitive inducement, it would be more wholesome both for teachers and taught. The danger of slackness must not be overlooked, however, and some external test and outside criticism are highly desirable, to prevent the standard, whether of aim or of industry, from going down. That is the object of external examiners at a University : a wholesome breath from outside, a conference with other Masters of a subject, is a help, and is felt to be a help, to all. But these external examiners co-operate with the internal examiners or teachers : they do not set questions in entire independence of them, without knowing or caring what the students have been taught, nor what range of subjects has been attempted ; and they do not determine results on the outcome of a few hours' paper work,

in isolation from the teacher, who knows the students well, and with no regard to the record of work done during term.

In all this I myself hope to see some approximation in school procedure to that which has been found to work well in College procedure ; and in so far as it does not work well in any school, it must be because the teachers in that school are either incompetent or lazy. To guard against this there ought to be discrimination between the schools admitted to share the benefits of the new system : they should be inspected and approved schools : it cannot be extended to unknown and uncriticised institutions of no recognised status.

The new system is embodied in our scheme for ' School certificates '—at one time called ' Leaving certificates.' It is not yet fully in action, but its steps have been passed, and there is nothing to prevent its coming into action almost at once.

The school certificates are of two grades—senior and junior ; they are conferred on

a sufficient range of subjects, to be chosen by the school for each pupil; the certificate bears on its face the subjects in which it qualifies, and the University will accept the senior certificate as excusing from a Matriculation test in those subjects. So will the Institute of Accountants, the Law Society, and the War Office, as excusing from their preliminary examinations in the subjects covered by the certificate. It is hoped that this will be felt to be, so far, an emancipation and a boon to the teacher; and the list of accepting bodies must soon, we hope, be increased. I trust that before long it may be possible for all recognised Universities in the British Empire to be willing, as regards these preliminary tests or entrance qualifications, to accept each other's results.

But to go back to school examinations. For really educational purposes, I am convinced that they should be conducted chiefly by or in co-operation with the teacher—the competent teacher. If people are competent



to teach, they are competent to examine, so long as they will play fair. Anyhow, the questions should be set by those accustomed to teach children of that same sort of age. Knowledge of a subject, and the light of nature, are insufficient preparation for being a good examiner : it is a difficult art to set really good questions, except at a more advanced stage.

At a stage when almost anything may be asked, as in senior physics, it is easy enough to set questions ; but at an elementary stage, though it is still easy to set questions, it requires experience as well as common-sense to set good ones,—questions, that is to say, which at the same time afford sufficient scope, furnish an adequate test of ability, are not too hard or too catchy, and are not too difficult to evaluate and ‘mark.’

However the questions are set, it is certain that practice in answering questions, the habit of having knowledge ready and available, is most useful ; and a valuable faculty is thus cultivated, a faculty service-

able in after-life,—which in a very real sense may be said to be a constant examination, a test of power, knowledge, and readiness.

Witness the surgeon called upon at a moment's notice for a difficult and dangerous operation : can there be a more stringent examination than that? Witness the preacher called upon for a moving exhortation before a critical audience. Witness the young barrister given the opportunity of his life to plead in some prominent trial. Witness the engineer or the architect afforded the opportunity of designing and constructing a structure which shall withstand the operation of adverse forces, and extort admiration from adverse critics. Witness the actor on the occasion of a first night—or, for that matter, any other night, if he is to do his best. Witness the statesman when he catches the Speaker's eye, or has to bring in his first budget. And so on. The art not only of assimilating but of reproducing knowledge, clearly and in-

telligibly on demand, is by no means one to be despised.

This is the kind of faculty which examinations test, or should test ; but it should be information that has really and truly been assimilated ; it should not be a flower without roots, grown by somebody else, cultivated elsewhere, and then stuck in the examinee's pot for show purposes until it withers.

All that compulsory getting up of subjects, for immediate display and speedy abandonment, is a useless strain ; though it must be admitted that even that is a sign of ability. I do not deny it ; a person who has no brain-power cannot get up a subject quickly, so as to retain it for a week or even for a day ; and the faculty so trained may be useful to a barrister, who wishes to have a case at his finger-ends for a time and then mercifully forget it ; but the learning is artificial, and it is rather a severe strain. If applied at all, it should not be allowed to enter into the backbone of education, nor govern the basis of knowledge on which professional training

is to be based ; it is only applicable to the temporary and the trivial, not to principles but to details ; it is rather like the everyday events or book of engagements in ordinary life, items which are not worthy of recollection beyond the hour of use.

In so far as such temporary cram pretends to be real knowledge, it is fraudulent ; and hence, except for exceptional testing purposes, and ascertainment of exceptional ability of that speedy and temporary kind, it should be discouraged.

The object of education should be to make niches or pigeon-holes in which facts can be stored automatically and without labour, in orderly accessibility, as part of the furniture of the mind. A wastepaper-basket full of information is only serviceable for the purpose of lighting an examiner's fire at midsummer. I am speaking just now rather to the University students present. The examiner does not need the information, nor does he value it, but he receives it for whatever it may be worth, and cannot

but acknowledge its receipt with a pass certificate.

Yes ; and that is why I believe that September examinations are better than those held in June. The period of the long vacation is desirable for the process of soaking in, and also for the opposite process of forgetfulness to take effect. It may be urged that it is a hardship to keep the brain simmering with materials for three months ; and perhaps it is ; but that which is going to be so soon forgotten cannot have been really and effectively known. At the same time, the questions set for a September examination—indeed, I believe, for any pass examination—should not be on trivial minutiae, the mere fringe and outskirts or decoration of a subject, but should be directed to salient features, and test real and permanent and sound knowledge. That the questions seem easy to the expert who sets them, and can be answered without difficulty by all other experts in that subject, is no objection, but rather a desirable

feature, not always satisfied. Pass questions are often too hard ; and good answering, accordingly, too impossible. I had rather have good answers to easy questions than bad answers to hard ones, and I believe they are a much better test of knowledge. Good answers to easy questions cannot be crammed. It is the trivial points, and the answers to hard and accidental and faddy questions, which can be crammed. These are they which are got up in May, and produced, undigested and unassimilated, in June. “*As if*”—says Epictetus—“as if sheep, after they have fed, should present the shepherd with the very grass itself which they had cropped and swallowed, to show how much they had eaten, instead of concocting it into wool and milk.”

A trenchant simile.

*Interrogative Instruction.*

Examination, however, in its proper place, is a necessary adjunct to teaching, that is to say, judicious questioning is one method

of teaching ; so as to draw out, as Plato paradoxically says, what the pupil really knows all the time, and bring it into his consciousness, instead of trying to graft it on artificially from outside. Neither method should be blindly followed : some things must undoubtedly be told the pupil, other things he should be led to discover.

To tell him the name of the gas given off when chlorate of potash is heated, and to demonstrate some of its properties, is in accordance with common-sense. To tell him the ancestry of William of Orange is also necessary, unless the plan be adopted of putting books in his way and asking him to find out. To tell him the result of dividing 365 by 7 is only justifiable if a train has to be caught, or if there is some other occasion for hurry.

To tell the pupil a proof of the 47th proposition of the first book of Euclid may be ultimately necessary, but it is desirable that he should have some empirical acquaintance with the proposition first, so that he

should know the fact by experience, and be ready to welcome a proof when it is forthcoming. For what does a 'proof' mean? A proof means destroying the isolation of an observed fact or experience, by linking it on with all pre-existent knowledge; it means the bringing it into its place in the system of knowledge; and it affords the same sort of gratification as finding the right place for a queer-shaped piece in a puzzle-map. Do not let those puzzle-maps go out of fashion: they afford a most useful psychological illustration; the foundation of every organised system of truth is bound up with them. They admirably illustrate the proof by consistency, the fitting together of knowledge into a coherent scheme; which is the essence and whole meaning of Science in its broadest sense, *i.e.* of scientific method, to whatever kind of subject-matter it is applied.

It is because a number of phenomena, such as clairvoyance, physical movement without contact, and other apparent abnor-



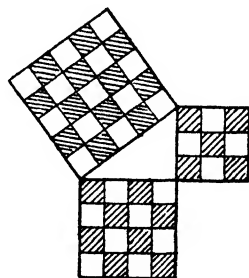
malities and unusualnesses, cannot at present be linked on with the rest of knowledge in a coherent scheme—it is for that reason that they are not yet generally recognised as true ; they stand at present outside the realm of science ; they will be presently incorporated into that kingdom and annexed by the progress of discovery, but meanwhile they are not appropriate for general College treatment or for educational purposes. Like all unknown and mysterious agencies, they are apt to lie for the present in an imaginary region of superstition, the tract of the extra- or preter-natural ; not that there is really any such region, except subjectively and to our present knowledge. In so far as these things are real, they will fit simply enough into an enlarged scheme by and by, and be recognised as facts of illuminating importance. Meanwhile, it is rather too much the fashion to deny their existence, and even to base prosecutions upon them, because they are not yet understood, and are liable to be abused. The amount of protection to poor and igno-

rant people afforded by these somewhat stupid prosecutions is very small, and as I think unnecessary : there are quantities of sharpers from whom they are not protected ; some, indeed, whom the law actually assists. I wish it were true that *de minimis non curat lex*. Some day the fact will be quoted by our descendants as noteworthy—that prosecutions for crystal-gazing and clairvoyance, even though those powers are sometimes pretended rather than real, lasted on into the twentieth century.<sup>1</sup>

To return from this digression, I must enlarge a little upon what I mean by experience of the 47th proposition before proof. The experience can be gained by children when they are playing with square wooden bricks. Ask them to outline a triangle with

<sup>1</sup> It may be desirable to stop public exhibitions of hypnotism, and, of course, anything that becomes degrading, under the common law ; but the prosecutions which I regard as unnecessary are those directed to prevent people from paying for a consultation, which they find comforting, with persons whose business it is to advise and exhort, under conditions of either real or pretended inspiration, for a moderate fee.

such bricks — different kinds of triangles ; they cannot, indeed, make all kinds in this way, they can only make commensurable triangles, that is, a quite exceptional kind ; no matter, let them make those, by surrounding an area with square blocks. Let them thus make a right-angled triangle. They will find that they have to make one with sides 3, 4, 5 ; or 5, 12, 13 ; or 8, 15, 17 ; etc. Take the 3, 4, 5 triangle as the simplest, and let them study it ; presently lead them to



build up a square on each side and count the blocks in each (see figure annexed :  $9 + 16 = 25$ ). They will seize the idea in time, I should judge : and if they do, they are not likely to forget it. It is a representative natural truth, true throughout the universe.

A figure like that, depicted on a huge scale on the Sahara, has been suggested for planetary signalling ; *i.e.* for informing any intelligent race on other planets that the earth is inhabited by folk to whom the universal truths of geometry are known.

The 'canals' in Mars may or may not be artificial intelligent irrigation works—probably not ; but a figure like that would be proof positive of planetary intelligence wherever it was seen. If seen, it might conceivably be responded to ; not very likely, but possibly, by a race further advanced in recondite methods of signalling than ourselves ; hypothetical people on another planet, who at present may regard the earth as an insignificant globe, not worth notice ; a very wet planet, with its surface so extensively covered with water that it is hardly likely to be inhabited, except by fish and amphibious creatures.

Children will not see the importance and consequence of such a proposition, though they can be told that it is true for

every right-angled triangle, incommensurable as well as others ; true also about circles, equilateral triangles, or any similar figures depicted upon its sides, and not only about squares. They will still not realise that a whole science of trigonometry is based upon it—of course not : they will only realise that gradually ; and that of itself will be a valuable lesson, for it will bring home to them a most important and far-reaching thing, viz., the tremendous consequences involved in any simple actual fact. Any fact, however apparently trivial, may have portentous consequences. I am not now referring to the “flower in the crannied wall,” though that, too, embodies a great and mighty truth ; I am referring to the consequences following from anything which has the stamp of reality and effectiveness.

*Importance of simple details in the Scheme  
of the Universe.*

Take as an example the inclination of the earth's axis :—

We all know that the Seasons are produced by a tilt in the earth's axis, *i.e.* by its inclination to the plane of its orbit ; but how many bethink themselves of the magnitude of the consequences compared with the triviality of the cause. How many realise vividly that the gorgeous variety of the year—the beauty of spring, the glory of autumn, the severity of winter, the brilliance of summer—are due to the fact that the angle between the earth's axis and the ecliptic is not  $90^\circ$ , but is nearer  $67^\circ$ . It would have been so easy for this angle not to be appreciably acute ; and if anyone had been told beforehand that he was destined to live on a planet with its axis tilted at  $67^\circ$  instead of  $90^\circ$ , he would have been a person of remarkable insight, or a reasoner equal in power to one of the great men of science, if he had been able to perceive all the consequences.

Again : Every particle of matter attracts every other particle with an insignificant and excessively minute force, difficult to

detect experimentally, one that could hardly have been discovered between ordinary masses by experiment ; but what are the consequences ? —

The fall of an apple, the collapse of a bridge, the fall of rain, the flow of rivers, the cohesion of an earth, the occurrence of the tides, the precession of the equinoxes, the orbit of a planet with all its perturbations, the existence of an atmosphere, the heat of the sun, the visibility of the stars, the whole realm of gravitational astronomy, also the shape of our houses and furniture, and the concomitant circumstances of every trivial action of our daily lives.

But to return to the square bricks of the figure above, and to the proposition unconsciously illustrated by them in play. This is an example of what Mrs Boole calls the preparation of the unconscious mind for science ; and this is the kind of thing which—to a great extent wisely, to some extent, in my judgment, exaggeratedly—she advocates,

especially for preparatory work by parents at home.

If her books are read with common-sense, and in a sufficiently critical but not carping spirit, they will be found to contain many useful hints, especially in the early stages of mathematics. Mathematics is her pet hobby, and her hints at preparing the child's mind unconsciously for the reception even of some of its less elementary portions, later on, are distinctly valuable.

The small book called *Preparation of the Child for Science* was published last year by the Clarendon Press, and I commend it to your favourable though critical attention.

As another example of preparing the infant mind, take an illustration of *discontinuity*, such as is afforded by the drawing of a ring, with dots or a smaller ring inside; they appear to be disconnected, and on the paper they are disconnected; but if thought of as the section of a flower, it is perceived that they may be connected in a third dimension off the paper. So are



all islands connected, beneath the sea. And so also may two detached circles be thought of as the section of a ring, etc.

At a much later stage it may be possible to extend this idea of connected discontinuity to examples of what are sometimes considered cause-and-effect connection, or to events which are not simultaneous at all, and are connected, outside our space altogether, only by means of time: a shell, for instance, in its loaded condition before explosion, and the same metal in shattered fragments subsequently; or to take a better example, an oak and an acorn; or, say, a boy and a man: the complete individual, and the full meaning of identity, are evidently not given by his appearance at any one instant; his whole life-history is involved, if he is to be regarded as a complete being; his instant individuality is clearly but a section of a larger whole; how much larger that whole may really be, it is perhaps not quite competent for us at present to know.

*Notebooks, Translations, and Examination  
Papers.*

In throwing out suggestions to teachers from my own experience, I must be understood as leaving it to their own judgment at what age they are applicable; but I have found it very helpful to be particular about notebooks, and to encourage the habit of writing up and keeping elaborate notebooks. Many of my own notebooks I have found useful in later life. For instance, in Higher Mathematics, if properly written up and indexed, they are easier to read and refer to than a text-book is, because they are already in subconsciousness known. Moreover, some of the lectures of W. K. Clifford, for instance, have never been published; and if I had not unfortunately long ago lost one of the best of my notebooks, embodying these lectures, it would be well worth publication.

It may be that in thus speaking of notebooks I have College teaching naturally in my

mind, but I suppose that in the higher forms of schools something of the same sort is appropriate. What I have encouraged is the use of inexpensive notebooks, 'subsequently collected and bound together : or such of them as are worth this treatment. The idea of permanence encourages care and pride in the keeping of the notebook ; but the notes of a lecture should always be written out fair, the original notes taken at the time are of no future service, for they soon become unintelligible. They should be amplified from memory, and written up in proper style ; and the teacher should be willing to supervise these fair-copy notebooks, and to utilise them occasionally as partially equivalent to a very prosaic and rather mechanical English essay, criticising them from that point of view, as well as from the point of view of subject-matter.

Take the case of translation also, as an instance. A translation should not only be verbally made, it should be written out ; and it would be well if it were written

out twice : at first literally, in close correspondence with the text ; and next, really Englished—that is to say, thrown into proper literary style, as well as can be managed—giving the spirit of the text instead of the letter—an admirable exercise in composition ; and these things should not be done on untidy slips of paper, but in a form that can be kept. It is not a bad plan to write in copybooks, and then have these copybooks subsequently bound together. But a notebook should not have too small a page : some such size as  $9" \times 7"$  is suitable : little rubbishy books should not be allowed : they do not conduce to carefulness and pride. For some purposes I have found squared-paper notebooks useful, and a cheap copybook full of squared paper should always be available for diagrams, for geometry, and for plotting of curves.

*Double Use of Examination Papers.*

So also with regard to examination questions : if they are good ones they are

worthy of more attention than can be given during a two or three hours' answering of the paper, without help, for testing purposes. Testing is one use of examination : education is another ; and after an examination paper has fulfilled its original intention, and been employed for testing the unaided knowledge and ability of a number of pupils,—for it is not only knowledge but ingenuity also that is tested, by problems explicitly, and by style of answering constantly,—then the paper may be utilised for its further function, and the pupils may be encouraged to answer it again, or to answer some questions in it, with ample time—days or weeks—at their disposal, and with the aid of notebooks, books of reference, help from each other, laboratory trials, anything that can be obtained and used, anything short of mere stupid copying. I have been surprised to find how little the answers are improved, by this permission, over what was given on the first occasion : the good students, of course,

gave good answers at first ; the bad students, who gave bad answers, seem incapable of giving any better ones, and either bring in irrelevant matter, or else take no trouble to answer properly at all. But the reason of this is, I think, because they are unaccustomed to the process of acquiring information for themselves : they do not know where or how to look for it : people are too little trained to be able to look things up, or find things out, for themselves. The best way to find things out would be to work in a laboratory as well as to read books, but few know how to set about that, except in connection with some set task. Nevertheless, this is the kind of competence that *should* be the result of education ; and every student would be instinctively aware that it was a useful acquisition, and worth the trouble, if only he could do it.

*Measurement : its Use and Abuse.*

I said last time that measurement and quantitative experiments might be overdone,

if the phenomena to be measured were not familiar. That is so ; but nevertheless there is a great advantage in encouraging careful measurement and exact statement in its proper place ; for instance, the measurement of heights and distances—elementary surveying—is interesting enough, and I see no reason why a sextant should not be employed. I conjecture that a sextant would be a good instrument to encourage the use of : it is cheaper and more portable than a theodolite, and it would serve for most angular measurements. It would be handy at the seaside for practice in astronomical time and longitude observations. Probably other methods, such as are known to surveyors and travellers, a plain-table and the like, would be better on land.

As a model for exact school experimenting, and for the mode of statement of such experiments, I commend the study by teachers of the early parts of Newton's *Optics* ; which describe simple and epoch-making experiments in a style perfect and

classical, such as professional physicists of to-day hardly seem to have leisure for, but such as some of us might quite well be the better for.\* There is, however, or ought to be, at school, plenty of time for this sort of thing; anything that is hurried and slipshod and inaccurate and incomplete, thereby loses much of its disciplinary and educative value.

Insufficient attention is perhaps paid by professed teachers of science to the scientific classics; to such lectures as those of Thomas Young, for instance; to the works of Fresnel, Carnot, and many other brilliant and clear thinkers. Of all the classics, doubtless the *Principia* is chief, but it is too hard for school use. Newton's *Optics* is easier; and the early steps in the discovery of spectrum analysis which are there recorded in the early chapters are full of simple interest to the physicist.

Newton was accustomed to make measurements of everything he observed: for instance, the well-known colourless halo round



the moon he measured, and found it to have an angular radius of  $22\frac{1}{2}^{\circ}$ , which he recognised as the angle of deviation caused by a  $60^{\circ}$  prism of water, and hence stated the theory of the halo, viz., that it must be caused by ice-crystals in the upper air, because crystals of ice are characterised by angles of  $60^{\circ}$ .

Even as a boy we hear of him, in the storm on the day on which Cromwell died, endeavouring to measure the force of the wind by comparing how far he could jump with it and against it.

Accurate and metrical observation of any phenomena of sufficient interest and importance is thus clearly a thing to encourage, and a record of the measurements should be made and kept. "What is worth doing is worth recording" is probably a legitimate rule, though no doubt it has exceptions. "Science is" not "measurement," any more than "genius is patience," but in both cases it is one real ingredient which has thus been proverbially taken for the whole. It is

quite possible to overdo measurement in a school laboratory, but in most schools this aspect of natural knowledge is insufficiently attended to ; and I quote from the address of the President of the Royal Society, Sir William Huggins, delivered three or four years ago, as follows :—

“ It is noteworthy that the words of one of the most distinguished of the early Fellows of this Society are applicable to the present day. In 1675 Evelyn addressed to the Society the complaint that ‘at most schools there was a casting away of six or seven years in the learning of words only, and that, too, very imperfectly.’ What he asks for is, that a method should be established for infusing knowledge and language at the same time, so that school training should become a real apprenticeship in Natural Philosophy.

“ No doubt, during the last two centuries and a half, some improvements in the methods of teaching, and some widening of the subjects taught, have come in ; but to

a large extent Evelyn's complaint still holds true.

“What are primarily needed are improved methods of teaching languages and mathematics, as well for the sake of these subjects themselves, as to afford time for the early collateral study of such subjects as are fitted to develop the powers of observation, of inquisitiveness into the nature and relations of natural objects, and of reasoning therefrom.”

*Teaching of Science in general.*

Science is best taught and best assimilated in the nascent stage; the stage of growth and development, the stage of fresh perception and discovery; its special aroma is lost if it is imparted as a thoroughly understood and organised system alone, though that too is, of course, one aspect of it. The fringe of knowledge, the boundary between acquisition and ignorance, is always the most exciting region; just as geographical excitement is keenest in the exploration of new countries. No one can

help being interested in a subject in that stage.

Now, in a progressive science like Physics, there is always a tract of it conspicuously in the throes of development. Some inklings of it get into the daily press, and it permeates the atmosphere of the country. This adventitious and popular interest should be made use of as a stimulant, and employed so as to encourage at any rate some percentage of youth to settle down to serious study, so as to understand these things, not superficially, but more substantially.

But there is another mode of obtaining science in a nascent stage, viz., the historical mode, pointing out some of the steps which in the past led to discovery, and not giving the full-blown result apart from the earlier and less coherent steps which led to it.

Mach's History of Mechanics<sup>1</sup> is an

<sup>1</sup> The late Professor Mach, of Prague and Vienna, whose works have many of them been translated at Chicago. The title of the one above referred to is *The Science of Mechanics*; it consists of history and a good deal more.

interesting book for the teacher of mechanics to read, in order to enliven and humanise his teaching. Mechanics is an excellent school-subject, partly because it is so exact and formal ; but even that had its nascent stage once, and the teaching of science should never be limited to dull and desiccated details. The tract of growing science in which the public is at any time interested is a comparatively small region ; but by drawing on the history of the past, an unlimited supply of nascent science is available, and should be judiciously intermingled with the more thorough instruction and drill in the highly organised and elaborated system of knowledge ; though even there, at every point, fresh avenues for development and growth are liable at any moment to open out to those who are keen enough to perceive them.

No part of science ought to be dull or hackneyed, since all finite knowledge must have an infinite boundary or margin.

Doubtless some will feel the fascination of

this more than others, and only a few will wish to proceed deep into scientific studies ; but everyone ought to be initiated into the general atmosphere of science, and get some notion of the universe in which he lives ; otherwise he must be afflicted with a certain amount of incompetence, and at the best he loses considerable interest in life by being unable to follow the advances of his day, or to understand the language in which they are expressed.

The present total ignorance of mathematics on the part of the average man is responsible for his incapacity to understand the truths of physical science, or to appreciate anything more than their barest and crudest outline. A whole mine of wealth is inaccessible to those ignorant of even the alphabet of higher mathematics ; and the current ignorance is largely due, as I believe, to the slow and over-laborious methods adopted in what is considered a thorough and disciplinary apprenticeship to its rudimentary portions.

This idea of thoroughness is responsible for much evil in school teaching. School teaching has plenty of discipline, and discipline is by no means a thing to be ignored; every precept must be applied with common-sense; but the attempt at initial thoroughness over a microscopic quantity of geometry and algebra prevents there being either time or inclination for a survey of the field. And, moreover, true thoroughness is impossible of achievement. It is a chimæra. No one thing *can* be thoroughly known, thank goodness, unless vastly much else is known too: things are too interlocked and interrelated for that. Were we to forbid the study of biology till every part and function of some one animal were known, as well as, say, Professor Bridge knows them, the study would not progress; for the knowledge, thus isolated, would be impossible of attainment, even if the animal were no more complex than an amœba.

But in teaching the rudiments of mathematics, something like this is attempted;

and many boys and girls know in a verbal manner, and are able to say off, the early propositions of Euclid better than a mathematician. There is no harm in this ; there is some good if it comes easily to them, but it is not worth excessive labour and time ; for Euclid and the beginnings of algebra are to mathematics what a set of scales is to music. Suppose children were not allowed to hear a tune till they could play some fundamental and traditional exercise as well as Paderewski or the pianola could play it ; what would be their idea of music ? Would the name be suggestive of Apollo's lute ? No ; it would be exactly like their present idea of mathematics.

True thoroughness in the rudiments is only possible when progress has been made in the parts further on ; the higher parts react upon the lower. The full meaning and beauty of the base of a pillar cannot be perceived until the column is erected, nor can its harmony and appropriateness be æsthetically enjoyed until the capital is added



too, and some idea grasped of the scheme of the building of which it is to form a part.

But here a caution : In a few matters thoroughness is possible, and where possible it should be insisted on. Thoroughness is possible, for instance, in the semi-mechanical, but by no means to be abandoned, process of learning by heart. Let no one think I am against learning by rote. It is not the learning by rote that is bad, it is the having to learn rubbish by rote.

Whatever has to be learnt without present or recognised interest—and there is much of that kind that can and should be learnt by children—should be learned in smart, disciplinary, stringent manner ; for a short time together, but thoroughly, and without any dawdling or inattention. The more relaxed unconscious kind of study, associated with bodily activity and with present mental interest, may be continued for longer spells ; but all severe disciplinary exercise—learning by heart of unintelligible or only partly

apprehended matter—should be brief, brisk, and thorough, as well as devoted to carefully selected matter.

Everything that is to be learned by rote should be severely criticised by the teacher beforehand and should pass the test ; but once determined on and attempted, it should be learnt thoroughly. A thing half learnt is but little use ; it is no solace hereafter, it evaporates ; but a learning of the exact words of splendid literature—of Isaiah, for instance, or Wordsworth, or Tennyson, or Virgil—how many men and women have not blessed the instructors who constrained them, when young, to learn, in a permanent and effective and exact manner, such music as that !

Thoroughness in word-accuracy is possible, and should be scrupulously insisted on : any slipshodness in reciting real literature is illiterate misquotation, to be stringently forbidden. But thoroughness in comprehension is not possible—no, therefore do not insist on it ; let the

superficial meaning be grasped—as far as possible being brought out by questions rather than instilled by assertion—and let the deeper meaning hereafter dawn.

Poetry is eminently a thing to be learnt by heart, and it comes between such disciplinary work as the multiplication table and the more interesting studies connected with bodily activity, such as drawing, experiments, and the like. Some poetry there is which is well worth learning, even though it cannot be fully appreciated by a child; other poetry there is in which a child can take an immediate interest; and I am informed by an experienced teacher of small children, Mrs Sonnenschein, that dramatic poetry is especially of this latter order. By dramatic poetry is understood such things as *John Gilpin*, *How they brought the good news*, Macaulay's *Lays*, the story of Joseph in Bible words, Rossetti's *White Ship*, *Kentish Sir Byng*, *Boadicea*, parts of *Lay of the Last Minstrel*, scenes from *Midsummer Night's Dream*, and many others. This teacher

advocates giving what is first-rate at the outset, and asserts that it is specially appreciated by children if the dramatic element is attended to, so as to give a feeling of reality at the time, and to make use of their instinctive acting and imitative tendency.

Not everything can be learned by heart, but many things can be read aloud, and read with dramatic intensity : a few of them can be learnt : all should be enjoyed.

Poetry, like real literature generally, is one thing which everyone admits should be learnt by heart. What else is there ? One very useful and practical thing there is, viz., the multiplication table. It is a hard thing to learn, but it is necessary. Teachers should remember that it is hard and dry. It is one of the things on which discipline can be rightly exercised ; and if they wisely weaken the severely disciplinary aspect of more entertaining subjects, they can always compensate by extending the multiplication table to 20 times 20.

Then, again, there are a few scientific statements of extreme and fundamental importance which are worthy to be learnt by heart; though the only examples I can at the moment unhesitatingly insist on are Newton's *Laws of Motion*.

It is not a bad test, when considering what is worthy to be learnt by heart, to think whether it is the sort of thing which every cultivated foreigner would equally be glad to know: whether, in fact, it is of world-interest or of world-beauty; all the things I have mentioned are.

### *Historical Sequence of Development.*

It is known that each animal in its early stages runs rapidly through the stages which in the past its race slowly and progressively accomplished; so that in embryology can be studied an epitome or rapid summary of the history of the race. This process must, I think, be understood as extending into child-life; and so the infant must go through its savage period, when cruelty

and self-will are not unnatural to it, though it is to be hoped, and I believe is often found, that these evil stages can now be passed through with great rapidity. I have no faith in the natural badness of children when wisely treated: society, for the most part, rears its own criminals. But there still remains the natural aptitude of the young for air, exercise, and country life, love of animals and the like, as distinct from life in crowded streets and school-rooms. To keep a small infant at attention, and without movement of limb, for too long together, must be essentially mistaken, or even cruel. The tendencies and natural activities of childhood may be understood by thinking of the past history of the race, and our business is to get through the undesirable stages as quickly as possible, without imagining that we can cut gaps out of nature and dispense with them altogether, except by undue force and distortion. This, however, is now becoming understood; and societies

for learning from, instead of domineering over, childhood exist. With all the resources of literature, tradition, and history at our command, it is hard if we cannot utilise the ancestral cravings and hero-worship of children to elicit more rapid progress: supplying at each age, as far as possible, the pabulum appropriate to that age.

“Echoes of the remote past of the race must remain,” as Stanley Hall says in his book on *Adolescence*, “but these must be rescued from the danger of loss, and utilised for further psychic growth. So, too, in our hothouse town life, we must in some sense ‘teach nature,’ though the very phrase is ominous. We must encourage visits to field, forest, hill, shore; we must draw attention to water, flowers, animals—the true homes and interests of childhood in that wild undomesticated stage from which modern conditions have kidnapped and transported him. At this stage, which of course differs in duration with different

children, books and reading and school confinement are necessarily distasteful; soul and body cry out for a more active objective life, to know nature and man at first hand."

When we transplant them into a school-house and shut them up for concentrated and undiluted study, we should see to it that the time is strenuously occupied and is not too long. Little can be done in the early age without the constant presence and stimulus of the teacher. The wise treatment of children is most difficult, but it is a subject well worthy of study, and cannot be evolved by each teacher for him or her self. It is a subject which has required and received the attention of generations, and must receive the attention of many more. There is a theory to be known and a practice to be learned; and training for properly dealing with all the early years of childhood is absolutely essential to the teacher. The idea that training can be dispensed with, and replaced by natural instincts, is as absurd as to suppose



that a doctor can cure disease by natural instinct, or an engineer build a bridge without training. Accumulated information of the race *must* be handed down among teachers, as among every other profession ; and a period of training—more thorough, as I believe, than is even at present recognised—is an absolute essential, if the teaching profession is to take its due place, receive its due honour, and perform its due work, in the world.

## LECTURE IV

### CHIEFLY ON BOARDING-SCHOOL PROBLEMS

I AM beginning to think that the boarding-school system, as established and grown accustomed to in England, is an institution that requires reconsideration, and to some extent reorganisation.

To say that we have grown accustomed to it is a small part of the truth, it is a system grafted into the fibre of English Society. If all were well with our social arrangements, reform might slumber, but if all is not well, it behoves us to enquire into causes; and to me I confess one of the deeper causes seems to be connected with the accepted and traditional system of the public schools, upheld as it naturally is

by the conservative affection of seniors and the exuberant self-satisfaction of juniors. To suggest improvement is to become unpopular, and it is easy for one's words to be garbled into absurdity and translated into offence.

With all that I have said by way of prelude I must risk that, and will throw out my criticisms in the hope that some of them may be useful to those who are more immediately concerned, and who possess more immediate knowledge and influence.

I venture to say that it is doubtful, and surely it has been felt to be doubtful by Headmasters of experience, whether it is really wise to remove boys from the natural influence of the family, and herd them together with others of the same sort of age, in order that they may be put under an artificial kind of supervision and discipline. It may be necessitated by our social arrangements, but it entails serious dangers, and demands justification in the light of experience from time to time.

As a rule, I have no faith in the educational policy of herding people of similar aims and tendencies together; nor need a house-master be specially qualified for the heavy weight of essentially parental responsibility involved. The burden thrown upon the teacher by such an arrangement is often too great. It is true that he is well paid for keeping a boarding-house, and in general is rather miserably paid for everything else; hence it is that he is found willing to keep the house, but it by no means follows that he is fit for the responsibility, nor, as a rule, can he spare energy for the onerous work of hotel-management and at the same time do the work of a stimulating and advancing teacher. Differentiation of function would seem to be "indicated," as doctors say. A master must often have to content himself with making friends of the prefects, and must leave a good deal of the discipline to them. So far as morals are concerned this may be sound, but the intellectual outcome is likely to be trifling. The middle boys

in a school, so long as they behave themselves and are inoffensive, can often pursue the even tenor of their lamentably ignorant way, without any encouragement to occupy their leisure hours worthily, and with no arousal of any hungry recognition of the value of life and of time.

Unless it can be shown that it is actually *done*, one would imagine that it was not possible for the head of a house effectively to supervise the boys' leisure and at the same time to teach in an inspiring and well-considered manner, so as to arouse enthusiasm for study. I do not myself believe that it is, as a rule, efficiently done ; and the difficulty has the result of unduly prolonging the time devoted to lessons. During lesson-time the boys are under some sort of discipline ; during play-time, while they are at games, they can be trusted to keep each other fairly up to the mark ; hence there is a tendency to make both lessons and games compulsory, and to lengthen the hours devoted to each, to the exclusion or mini-

missing of any leisure-time. Yet, in reality, it is the leisure-time that might be most fruitful in truly educational activity : it is then that free-will has exercise, and that organisation of life is to be learned. Discipline from without is good and necessary as far as it goes, but it is not everything. Self-control, and power and will to organise leisure, are far more valuable acquisitions, for they persist when the other is of necessity withdrawn, and it is these to which the conduct of subsequent life must perforce be entrusted. I will return to the utilisation of leisure directly, but meanwhile there are one or two other positive and negative remarks to be made.

### *Social Studies.*

In schools attended by the higher, or by those who are likely to be the governing, classes, whether it be in the nation or in the municipality,—and probably the next generation will see a considerable extension of local self-government,—I believe that a great deal

more attention ought to be paid to social studies, to acquaintance with British institutions, to a knowledge of the Poor Law, for instance, of the working of many other laws, of the land customs in this and other countries, and of the processes by which inquiries can be conducted and reforms initiated. This work is at present left too much to amateurs : men of ability, doubtless, but men often of insufficient knowledge. The tradition is that experts can always be consulted ; but a certain amount of knowledge is required before people are willing to consult experts, or to understand their opinion when given : as much knowledge is required in stating a problem as in drawing up a specification or presenting a legal case. For the professions, training is known to be necessary ; but for governing the country, or a city, training is thought needless—it can be picked up at the time. There is no need to make such training of the nature of what is called *ad hoc* instruction ; but an acquaintance with institutions, and with

social principles and laws, and customs and abuses, is surely a necessary part of the equipment of every citizen who is going to take a prominent or commanding position. We shall never get efficiency, or even competent ability, out of either peer or commoner, on the average, unless something in this direction is attempted.

It is never an easy matter to determine the best way of attacking any abuse or evil with the object of reform, and it always needs study: usually it is best done by a method of "indirection," by the method of flank attack, and by the raising of apparently disconnected issues. This is too large a subject for a parenthesis, and I merely give one illustration of what I mean by "indirection." The best way of attacking national drunkenness is probably not by closing of public-houses, but by opening of other places of rational recreation, and especially by providing better homes. The positive and plenary method of treatment is nearly always better than a negative or



vacuous method. Adolescence is the period we too much neglect.

There is certainly something about present school teaching which does not to any great extent bring out products of value, even though the school years are prolonged to the age of nineteen. Some of the men who represent the average, or even the higher, product of our chief public schools and our chief colleges, are more or less futile for any serious purpose in life. They have excellent manners, they can own a banking account with ease and amiability, and they have a taste for good and luxurious living. Some of these youths have had every advantage throughout their lives ; that is to say, they have not been handicapped by fortune in any way ; yet they can do no one thing better than other people. I do not suppose they can even shoot as well as a gamekeeper : in all the facts of the universe they do not pretend to be anything but supremely ignorant. It is difficult to realise of what use a certain percentage of

our present aristocratic and plutocratic youth are going to be in their day and generation. Fortunately, there are many brilliant examples to the contrary; but it sometimes seems to me that it is by force of character and innate ability and wholesome home influences that these great and self-sacrificing servants of the State have blossomed into what they are, rather than as a consequence of school training and education.

*Unsocial Customs.*

There are several ancient school customs, not yet wholly gone out of fashion, which I want to condemn. Any school which tolerates the fag system, whereby the smaller boys are made the servants of bigger ones, sometimes the petted and spoiled favourites, sometimes the overworked and beaten slaves—and I hardly know which is worse,—this system, wherever it still survives, is, I venture to think, perpetuating a moribund abuse in a spirit of thoughtless conservatism.

Fags enable fewer domestic servants to be kept and they encourage the bigger boys to have things done for them in a way to which they are already far too much accustomed in wealthy homes.

The idleness and luxury of the over-gilded youth is appalling, and constitutes a greater temptation than human nature ought to be called upon<sup>d</sup> to stand. This applies chiefly to life at home ; at school there is often a contrast, sometimes a one-sided and unreasonable contrast, leading to withholding even of necessities, in the interests of misplaced economy. Insufficiency of food, and permission to eke it out by purchased supplies from a neighbouring tuck-shop, is a miserable custom, which I am amazed to find that conservative traditions still to some extent support. Parents ought to rebel against it ; they ought not to be called upon to send hampers, nor to supplement in any way the sound and wholesome and sufficient food for which they pay. If the

master is incompetent, as he probably is and almost ought to be, to keep a healthy and economical hotel and supervise the housekeeping, so as to see that only good things are bought and are properly cooked and supplied, then let it be done by someone who is bred to the business ; and let the profits of food-supply no longer supplement the inadequate fees paid for the proper work of education. This is a reform pressing and ripe for attention, and it might be carried by determination on the part of parents. I have seen it suggested that boys who do not complain of school food must be prigs. Not at all. At some schools boys complain ; at other schools they do not. When the food is good and plentiful they are quite aware of it, and will admit the fact simply and naturally. Some people think that plenty of food makes them greedy. The contention is absurd. If you want to make a boy gluttonous you will first starve him and then encourage him to buy confectionery. Thought and attention given to

food, during school days, must be taken from other things. To have to think unduly about such primary wants, to have to "take thought for the morrow," in this sense, is characteristic of uncivilised and prehistoric times, or of the exigencies of geographical exploration and military expeditions: it is also, alas, a real disability under which multitudes labour, in the heart of so-called civilisation.

Other reforms have perhaps already been largely effected since my youth. Any school in which it is the fashion to tease and annoy the raw newcomer, at a time when he is naturally miserable and homesick, is thereby and to that extent essentially vicious. There should be a close-time for bullying, even of a moderate description; the new boy should be allowed to get acclimatised before his level is taken. There are, or were, children, the offspring of crazily injudicious mothers, for whom one rather longed for the day when they would enter a public school and be kicked into some semblance of reasonable

humanity ; but these anomalous urchins, in these days of women's education, are, I believe, rarer than they once were ; and even for them a time of acclimatisation and sympathy, during the raw period of first separation from home, is legitimate, and only decent.

I know of a school where it is the unwritten custom for the bigger boys to help the smaller ones, in cases of trivial difficulty, with boots or clothes or what not, even throughout the school life ; the effect is to make the younger ones happier, but the reacting influence on the elder ones is decidedly good.

One does not want to make boys milksops and mollicoddles, but there are always hardships and roughnesses enough to stand at any healthy athletic school ; and whatever may be the beneficial effect of bullying on smaller boys, in the eyes of the good old conservative, the spirit fostered in the bigger ones by the safe and easy torment of the weak is a kind of spirit which most people would gladly

dispense with. There is no other condition of life in which people, necessarily differing in physical strength, are put to live together unaided : in later life, if the weak are assaulted they can call the police, and the embargo on 'telling tales' is removed from witnesses in a court of law ; at school there is no such relief or protection ; and if it is legitimate at all to leave the strong and the weak together, it must be made so by the inculcation and practice of what are essentially minor Christian virtues, by those upon whom age and circumstance confer power and responsibility. The opposite condition of things among adult people is hideously exemplified to-day on the Congo.

*Utilisation of Leisure.*

However, on the whole subject of boarding-schools and crowded houses, I do not wish to dogmatise ; I have insufficient experience. All I say at present is that I believe that there are many matters which require reconsideration, and overhauling or

justification, as the case may be ; the system should be put on its trial. I incline to think that if a fair living could be made by assistant masters without the terrible responsibility of keeping a juvenile hotel, full of boys at a most troublesome age, few would undertake it. Those few would probably have a genius for the work and might do it well, but it is unlikely that they would be likewise able to take the ordinary share in the intellectual work of the school. They might perhaps be able to do either ; I cannot see that they should be expected to do both.

I suggest differentiation of function. They would probably act as form-masters better than as subject-masters ; but it is unsafe thus to generalise. Under the present system a perfunctory instruction on traditional lines can be carried on by devoted people otherwise occupied or over-driven, but that is exactly not what is wanted. Efficient teaching of a class is a most absorbing and trying duty, and



people should come to it fresh, and have leisure for preparation and for keeping in touch with the best that is being thought and said in the world.

A few hours of really first-class teaching would be sufficient, and would achieve far more than the long dreary waste of time during which bodily activities are restrained, while mental activities likewise remain nearly dormant or are only half awakened.

Hours of study are too long. The extent of learning achieved during school is not so extensive as to justify the absorption of many hours a day. A few hours of intense application would be better and more profitable, besides being a much better training. Overlong hours not only waste time, they develop inattention—a most troublesome acquisition.

Some parents think that inadequate time is given to *sleep* at schools. They may be right ; but I am sure that too few are available for leisure. Leisure of which no intel-

ligent use is made is doubtless dangerous, but the curriculum during school hours should be of such a nature that the time outside school is greedily utilised in order to supplement it. There are so many things to be done in this interesting world, I cannot think that idleness and indolence are natural to unsophisticated youth.

The acquisitive instinct, or instinct for collecting, can be utilised as a motive power instead of being allowed to drift into frivolous and useless channels ; it may result in a self-made natural-history collection of some kind, or other contribution to the school museum ; a carpenter's shop, a metal-working shop, a smith's forge, a laboratory, a garden, a drawing-office, all afford opportunity for intelligent activity, as well as the library. A skilled artisan of the right sort is an excellent instructor for boys, and one should be at the head of each of these establishments. Masters know too little—are bound to know too little : they can do part of the teaching, they cannot do all.

Mechanical experts, such as the highest class of workman, are extraordinarily skilful, and are instructive and interesting to nearly every boy. Girls have their own subjects of which they require expert knowledge, and I believe that in such respects girls' schools have been better than boys'. Parenthetically, I venture to urge cooking, laundry work, housekeeping, and 'cutting out,' as well as the various kinds of sewing. Not cooking only, but the buying of proper materials, the laying out of a given sum to best advantage, are important but neglected subjects : especially important in schools of the people. The elements of physiology and hygiene, respect and care for the body, based on some acquaintance with its intricate mechanism, are good for all ; so is the first-aid instruction given in ambulance classes. People who have been trained, even a little, are no longer appalled by witnessing an accident, nor do they shrink from wounds and blood ; they have some knowledge, they know they can help, and they welcome an

opportunity for service. This is the kind of spirit which knowledge always fosters ; nothing is so enervating and demoralising as theoretical ignorance and practical incapacity. Cowardice and feebleness are their offspring.

We have a number of artisan Instructors at work in the University. Men of the type of foremen are often men of very considerable ability as well as of handicraft skill, and they should be, and I believe are, looked up to by the students. We have a woodworking superintendent, a metal-worker, a drawing-office superintendent, a steel-melter, a head stoker, a smith, a miner, etc. ; and in each laboratory, such as the chemical, the physical, the biological, etc., the assistant is often a person of trained ability, whose constructive workmanship surpasses the skill of the students, and to whom they appeal for help. Still more should this be the case at a large school, and it would afford a real justification for the existence of large and expensive schools.

Recently it has been suggested that at schools of art also Artisans should be at work, so that the actual industrial operations could be seen and grown accustomed to by the pupils, who should no longer invent futile designs in the air, so to speak, or at least only on paper, and not know how they are to be executed in actual material. Carving and modelling and iron-work of course, but jewellery work, some branches of pottery, bookbinding, and the like, might go on in the immediate neighbourhood of the school, for a few hours in the day or evening, and be accessible to the students.

This suggestion has been quite recently made by some of the Art masters themselves, at a conference held last week in the University, and it chimes in exactly with the idea concerning schools, especially boarding-schools in general, which I have been trying to express.

All this is a sort of relaxation and unconscious education ; but for the severer

kinds of head-work, is not a total of six or even four hours a day amply sufficient, or more than sufficient, for young people? When they come to the student stage they can do more. Most of them can then do eight hours a day; some can do ten; a few, under stress, can do twelve. The majority would do well to be satisfied with eight or nine hours of thorough application; but for children, five or six, it seems to me, is as much as they should be called upon for; and I rather doubt whether three or four hours a day altogether of serious study (not all at once, of course) is not as much as is good for most of them, if the attention is to be strenuous and sustained.

*Art.*

I will not presume to speak on Art teaching, save to express my profound conviction that true and living art is impossible among a community which has no repugnance to ugliness in daily life. So long as towns are built in squalid ugliness, for the sake of

material gain divorced from all care for humanity, so long as advertisements are allowed to disfigure our landscapes, so that the countryside visible from a railway will presently become wrapt in the atmosphere of a kind of ugly town from which it is getting more and more difficult to escape ; so long as speculative builders are allowed to cut down trees and disfigure our suburbs by mean rows of ugly dwellings, while the efforts of those who would supply the country with much-needed cottages, having an individual and personal character, are hampered by the domineering interference of petty authorities ; so long will the true spirit of art seek other countries in which to flourish. Art is no affair of picture-galleries and museums, but should express the joy, the piety, the character, and the refinement of daily life. If these have no existence, then art is impossible. I do not for a moment believe that they *have* no existence, but I believe that they are not sown broadcast nor universally diffused ; the

energy and activity of the race are otherwise expended, and beauty is not a thing for which many English-speaking people greatly care, to the extent of being seriously pained by its absence. Hence what seems to me the best and safest training for children, at the present time, is the accurate and reverent copying of natural objects—stones, feathers, plants, and animals, objects of natural beauty precisely drawn and properly coloured, without any of the hasty and meretricious tricks of ‘brushwork’ and the like. Exact though elementary technique can be acquired; and the soul must enter, when it listeth, later on.

I observe in the local newspaper the report of an address delivered by Mr Prior, at the Birmingham School of Art, on Wednesday the 15th March 1905, which seems to me to contain truths forcibly put. If art-workers in England take rather too much the tone of a Jeremiah, it may be deprecated, but it is not altogether to be wondered at,—they doubtless feel, as



they go about our streets and look at some of our buildings, that they are preaching to a faithless and perverse generation. Some recent small erections in and near Colmore Row in this city are satisfactory. The old houses at the corner of Easy Row are always admired by artists, though I should not have been able to notice them myself. An obtrusive building has just arisen at the end of Edmund Street, a workman's insurance office, which, it would appear, is admired by the few British workmen who have spoken to me about it. They seem to take a pride in its meretriciousness, and in the amount of light and air which it blocks out: I wonder that they like their savings thus to be expended.

But when we come to the schools of the artisan classes, in spite of their strenuous and trained teachers, what can be expected when you think of the large classes and the leaving age? All that can be attempted beyond the merest utilitarianism is the pre-

paration of the mind, the awakening of some love of study, some intelligence or intellectual interest, at any rate, even though it only be in machinery, during the compulsory years ; the real education must be effected later, through the medium of voluntary evening-work, much of which now hopefully goes on ; and if some idea of art and of literature can then be enkindled, some wider avenues of thought opened up, the intellectual hope of the race is not yet extinguished. Reading, reading of novels, reading and real interests of all kinds—these means of indirect education, and cultivation of rational tastes, seem to me a far more hopeful method of preventing the lamentable misuse of the hand-worker's too scanty leisure, than any of the more direct—though perhaps also necessary—measures which are at present perforce advocated.

*Literature.*

And now, of all the studies which hold their own throughout manhood, and are

worthy and repaying objects of study, and form welcome deposits in the memory, I verily believe that literature stands chief.

There is no other such storehouse of noble thoughts, of finely expressed emotions ; through no other channel are we able to dive so deep into the springs and motive-impulses of humanity. "

Through translation the literature of the ancient and modern world lies open to us, but a splendid proportion of it is written in our mother-tongue. In a sense, there is no bad literature, for if bad it is not literature : books without style, mere compendia of information, may be useful for a time, like sundry text-books and dictionaries and Bradshaw, but a work of literature may exist in any subject, and is a perennial joy.

If I had time I would read you a few samples, chosen almost at random, from the world's literature. I read some Newton last time ; it is not, I perceive, suited

for reading for enjoyment, except by a physicist, but it is perfect in style for its purpose, and hence I claim it too as literature. As a contrast not too remote, I might read a little-known but characteristic bit of Ruskin,<sup>1</sup> to which my attention was directed by Charles Edward Mathews. I recommend for learning such a poem as Browning's "Abt Vogler," and Wordsworth's inspired ode on "Immortality." I might read also some Translations, for I

<sup>1</sup> From *Fors Clavigera*, quoted near the end of the translation by Forbes of Rendu's *Glaciers of Savoy*. "To a man of no essential power, the accident of a discovery is apotheosis; to him, the former knowledge of all the sages of earth is as though it were not; he calls the ants of his own generation round him, to observe how he flourishes in his tiny forceps the grain of sand he has imposed upon Pelion. . . . Whereas it may be felt in any single page of the writings of [worthy men] that they love crag and glacier for their own sake's sake; that they question their secrets in reverent and solemn thirst: not at all that they may communicate them at breakfast to the readers of the *Daily News*,—and that, although there were no news, no institutions, no leading articles, no medals, no money, and no mob, in the world, these men would still labour, and be glad, though all their knowledge was to rest with them at last in the silence of the snows, or only to be taught to peasant children sitting in the shade of pines."

want to emphasise the merit and beauty of translations; an extract from Murray's Euripides, for instance; another from the still more ancient writer of Ecclesiastes; and plenty more.

There are many kinds of literary criticism: one kind is a criticism of the history and circumstances of literature, and this should be learned and founded upon study; another is an attempt to realise the spirit and deeper meaning of a work, and this should be inspired and based upon experience of life and insight into human nature; another attends to the words and phrases employed, and this should be discriminating and subtle; another draws attention to the style and atmosphere of a writer, and this should be full of humour and appreciation. An excellent example of this last is afforded by a recently published local lecture, on "Style and Atmosphere," by Mr Cary Gilson.

The tendency, which we sometimes encounter among critics, to take a narrow

though consistent line, to apply one standard or test to everything, and to disqualify whatever does not come up to that standard, is to be deprecated, even though their standard is a high and noble one. To those who are critics I would venture to say, Cultivate an instinct for appreciation, and be not hasty to abuse. Or, as another experienced teacher of my acquaintance puts it : “ I would urge that practical teachers, whatever may be the exigencies of examination codes, should cultivate in literature a widely catholic taste—not to think that God lives only on the mountain tops, but that he is in the meadows too, and in the market place,

“ And all that beauty which from every part,  
I treasured up alway within my heart,  
Whether of form or face angelical,  
Or herb, or flower, or lofty cathedral.’

Very often the book passion is first aroused by the homely rather than by the sublime ; it may be kindled, perhaps, by coming across some sincere expression of just a slight passing feeling or fancy of one’s own—or some little

description of what one has vaguely noticed. Teachers might well encourage children to bring to the class anything that has thus touched their fancy. If the bit chosen is vulgar in matter or insincere in feeling or false in expression, then the children get their lesson in literary criticism ; and they get it on the only safe ground for a critic—that of sincerity of feeling and truthfulness of expression—whether it be the unconscious sincerity of old lyrics or ballads or love stories, or the conscious endeavour of our own time to describe, truthfully, feeling or dream or vision or half-caught glimpse of the meaning of life. From cases under my own observation it has seemed to me as if the literature of our own day, begotten of familiar circumstances, is most likely to rouse that tremendous first thrill of recognition of belonging to a race that can aspire, and feel deeply, and see lovely things around.”

*Moral and Religious Teaching.*

In advocating a broad outlook upon the universe, I owe to Sir James Crichton Browne the following quotation from an eminent medical teacher in Edinburgh of the last generation, the late Professor Laycock, who was known as a psychologist, as well as eminent as a physiologist and neurologist. He seems to have held the view that "ideas are causes not only of life and thought, but of all the phenomena of creation"; and in one remarkable passage, specially remarkable from a biologist, he says :—

"Man is at the head of a vast ascending scale of life, so extended in its connection downwards that for the present purpose it may be regarded as infinitely extended. With our existing knowledge of the uniformity of the laws of creation, the deduction is incontrovertible, that the scale of being is not truncated at man, and that beyond him there cannot be a dark un-



peopled void. The law of gradation of development, rigorously pushed to its legitimate conclusion, points out an infinite gradation of beings *above* and *superior* to man. That we cannot see such beings, or demonstrate their existence, is a necessary result of our position in the scale, and no proof whatever of their non-existence. The worm knows nothing of man, his works or his actions ; nothing of the sun or stars, or of the beings swarming around it ; and so with reference to the spiritual world—the world around and above us—our organs may be, and doubtless are, as imperfect as those of the worm with reference to the world around and above it. Man is, then, at the foot of another scale of being, the highest of which transcends man at least as far as man transcends the zoophyte. This proposition, I repeat, is the unavoidable inference from our present physiological knowledge, and it is a complete answer to those good, zealous, but not wise men who think that science leads to scepticism and

irreligion. It leads to a rational faith, utterly opposed to arrogant infidelity."

That ends the quotation ; and I say that of science, in its broadest sense, the last sentence is true.

Professor Macphail, of Glasgow, in an eloquent address to medical students on the Anatomy of Study, after enumerating the organs of the body, each as an analogue of some function of the mind, concludes thus :—

"And though I cannot tell where it exactly comes in, or in what it precisely consists, . . . I claim a Soul for study—a soul whose journey does not end in that studious training of brain and hands and heart which makes physicians and surgeons worthy graduates throughout the length of their days, but a soul which, upward and onward, to a goal above and beyond these things, is ever marching on. There is so much to be done in the day's work, so much to be endured, so much to be enjoyed, that there is often little time in

the course of it for contemplation of the goal ; but let us ever strive to keep green some cherished halting-places, where the rigours of the day's march can be forgotten, and where—

“In seasons of calm weather,  
Though inland far we be,  
Our souls have sight of that immortal sea  
Which brought us hither,  
Can in a moment travel thither,  
And see the children sport upon the shore,  
And hear the mighty waters rolling evermore.”

And so we come, lastly, to moral and religious teaching, without which we cannot hope to answer in the affirmative the searching question which forms the mainspring and lies at the heart of all educational reformers, “Is it well with the child,” is it well ?

Whatever views we may individually hold concerning the importance of dogma, —and I by no means undervalue its importance for theologians and adult philosophers, though I question its suitability and intelligibility to children,—there can be

no doubt that the practical virtues, of which mutual help and kindness are among the chief, are eminently suited to human beings at every age in life. Mutual help, consideration for others, chivalry to the weak, a kindly feeling for all,—these are things taught, though insufficiently taught as yet, in most schools of this country, from the primary village school up to Eton. But there are other matters than even these: enthusiasm for service, unselfish recognition of abuses, strenuous desire for reform, devotion to the real good of humanity,—these also are virtues of practical religion.

Hitherto we have been dealing with various forms of culture; and culture, as Matthew Arnold said, results in sweetness and light. Yes; but, says Henry Sidgwick, “religion results in fire and strength”; and he goes on to say, “the world at the present time needs fire and strength more than sweetness and light.” I am not sure that it needs one pair more than the other, but it needs both undoubtedly, though they

cannot always be combined in the same individual.

We are told that among the Japanese even military training is largely ethical ; that the soldier is instructed in self-sacrifice, public spirit, and other human virtues, as well as in the manual of drill and management of weapons. Events have rendered the truth of that statement certain : for that kind of soldier is undoubtedly the kind with which the most heroic feats have always been accomplished in history ; a fact which Cromwell knew well and applied in selecting his Ironsides. If it is the custom of people in the Western world to assume that the Japanese are devoid of any real and practical religion, they have not read the address of Togo to his subordinate comrades who fell in the war ; and they are constrained to attribute the behaviour of army and navy to sheer miracle, instead of to the noble possibilities latent in human nature when it is treated intelligently and developed. It responds splendidly, at epochs

of stress, even without moral and religious training, as we know from the behaviour of our own soldiers in danger and hardship ; but with such training a nation may become invincible, not in war only but in peace also, if it proves able to withstand the terrible temptations of peace.<sup>1</sup>

The essence of religious teaching, it seems

<sup>1</sup> It may be convenient to reproduce here the Address above referred to, as it appeared in the English Press, because it lets a flood of light on much which otherwise, to us Westerns, would be dark. Remember that it is a translation only, and remember the circumstances under which it was spoken : the victorious Admiral summoned to the Capital to be fêted and acclaimed, entered the building where a memorial service was going on to those who had fallen in the desperate maritime efforts before Port Arthur, and spoke as follows :—"As I stand before your spirits I can hardly express my feelings. Your personality is fresh in my memory. Your corporeal existence has ceased, but your passing from the world has been in the gallant discharge of your duty, by virtue of which the enemy's fleet on this side of the world has been completely destroyed, and our combined fleet retains the undisputed command of the seas. I trust that this will bring peace and rest to your spirits. It is my agreeable duty to avail myself of the occasion of my presence in this city, whither I have been called by the Emperor, to report our successes to the spirits of those who sacrificed their earthly existence for the attainment of so great a result. This report is rendered most humbly by me in person, Heihachiro Togo, Admiral of the combined fleets."

to me, is to get the human being to realise his place in the universe ; to realise the grandeur and at the same time the imperfection of things ; to feel that he is not a helpless spectator, but a competent artisan and co-worker, of whom much is required, and that he can be of real service in his day and generation. If he realises this, he is likely to become seized with the enthusiasm of humanity, and cannot but endeavour to serve his city and his nation.

We should realise gradually the truth and deep meaning of the old doctrine that the universe is not a "being" but a "becoming" ; that the present is meaningless save as a transitional instant between the past and the future ; we must realise also that we ourselves are not outside spectators, but that we are a part of the universe, an active part of the whole ; that each can mend or mar his part of the mechanism according as he mends or mars himself ; that it rests with him whether progress is a little more upward, a little higher, than otherwise it

would have been, or a little lower : it must be one or other—a stationary object in a flowing stream is a drag back, not a neutral and ineffective nonentity. The parable of the Talents should awaken an answering note, and the power and dignity of human nature, as a controller or assistant-manager for one department of the scheme of things, should be strongly realised. If it be possible to rise to a sense of filial relationship, and to work in the faithful and affectionate spirit not of a servant only but of a son, then not even the most orthodox would care to deny that an element of Christianity had been caught. These aspirations cannot be realised by a pupil unless the teacher genuinely feels them first. Not every teacher is likely to feel them, but then not every teacher will feel competent for religious instruction.

At present the sectarian conflicts of the Churches are supposed to be the bar to sound religious instruction, the most difficult and responsible of all. At present the supporters of religious teaching seem to me to be



occupied and busy about trifles, or about things which, though not trifles, are beyond the power of human formulation: refined theological doctrines, the product of œcumenical councils—these are not things with which children ought to be troubled. In their proper place, and as condiments, mint and anise and cummin are very well, and appear to add to the interest of grown people, but it is the weightier matters of the law which are suitable for children. Life to them is real and interesting; they long for guidance and information. A wide outlook on the part of their leaders is essential: the strong meaning at the heart of things must be keenly felt, and all notion of random and purposeless drifting strenuously discouraged.

Let folk, whether young or old, once fully realise that not only is life real and earnest, not only is the grave not its goal, not only is their future implicitly bound up with their actions in the present, but that the responsibility for part of the world's

progress rests upon them, that things will not happen unless they bring them to pass, that they can help to keep things from going wrong, and are responsible to some extent if things do not go right,—and these statements are, as I believe, literally and scientifically true,—then surely frivolity and stupidity and indolence will sink to their due and subordinate place, and emulation and hope and the best kind of ambition will rise instead ; a spirit of chivalry and enterprise will be enkindled ; and learning, as well as every other kind of preparation for worthy service, will be entered upon with zest and enthusiasm.

It is a great and dignified work which falls to the lot of you who are called to be teachers. The world does not recognise or duly honour the profession as yet, and perhaps it is as well, for honour brings its trials as well as its privileges. Many are excluded from your ranks at present by reason of the unattractiveness of the details, and the small remuneration attached to what, even in its

lower stages, is really one of the most direct opportunities for service that the world affords.

If from outside I may send a message into your ranks, I would say, Try not to get swamped with work and details altogether. Keep an open mind and eager heart for the broad truths of the universe and for the deep truths of the spirit. Realise also your place in the scheme of things ; never allow yourselves to lose hope or slacken in the highest faith, but strive so to perform the task entrusted to you that generations yet to come, though they may have forgotten your name, shall yet be better and happier for your once active presence on this planet.

# APPENDIX



## •        •        APPENDIX

*Extracts from an Address to the Royal Society  
delivered in 1902 by the President,*

SIR WILLIAM HUGGINS, O.M., K.C.B.

OUR system of higher education is too mediæval in spirit. In accordance with the traditions of the past, it deals with words rather than with things ; it is based too exclusively on the memory of what is known, and too little, if at all, on individual observation and reasoning.

The evidence seems clear, that the present inappreciative attitude of our public men, and of the influential classes of society generally, towards scientific knowledge and methods of thought must be attributed to the too close adherence of our older Universities, and through them, of our public schools, and all other schools in the country downwards, to the traditional methods of teaching of mediæval times. The incubus of the past makes itself felt, especially in

the too strict retention of educational methods in which the first importance is given to the reproduction of knowledge from memory, to the acquiring and applying of what is already known ; with little, if any, guidance and encouragement to the undergraduate student in the direction of research and of independent reasoning.

The first steps in the direction of true reform must be taken, it seems to me, by the Universities in the relaxation, to some extent, of the established methods and subjects of their examinations, for only in this way can the schools of the country, from the higher schools downwards, be set sufficiently free to be able to improve and enlarge their traditional teaching which has been carried down, with but little change, from the middle ages.

This is not the place for a discussion of the extent to which the studies of our higher schools, and secondary education generally, require to be reformed to meet adequately the larger needs of to-day, but it is obvious that the direction in which changes should be made is in that of the development of self-helpfulness and a spirit of free enquiry, as opposed to the traditional teaching of the past.

Above all things, such a practical study of natural phenomena should become an essential

part of our national teaching as would draw out and foster that noblest of our faculties, the power of image-forming in the mind, which, in its highest and productive form, does not consist simply of the reproduction of old experiences from the stores of memory, but by new combinations of them—as by a marvellous alchemy—so transmutes them as to lead to the creation of a new imagery. This creative use of the imagination is not only the fountain of all inspiration in poetry and art, but is also the source of discovery in science, and indeed supplies the initial impulse to all development and progress. It is this creative power of the imagination which has inspired and guided all the great discoverers in science.

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*Statement regarding Scientific Education in  
Schools, drawn up by a Committee of  
THE ROYAL SOCIETY.*

NOTWITHSTANDING efforts extending over more than half a century, it still remains substantially true that the Public Schools have devised for themselves no adequate way of assimilating into their system of education the principles and



methods of science. The experience of 'modern sides' and other arrangements shows that it can hardly be expected that, without external stimulus and assistance, a type of public school education can be evolved which, whilst retaining literary culture, will at the same time broaden it by scientific interests. On the other hand, it is admitted that many students trained in the recent foundations for technical scientific instruction have remained ignorant of essential subjects of general education.

The bodies which can do most to promote and encourage improvement, in these matters, are the Universities, through the influence which they are in a position to exert on secondary education. This improvement will not, however, be brought about by making the avenues to degrees in scientific or other subjects easier than at present. Rather, the test of preliminary general education is too slight already, with the result that a wide gap is often established between scientific students careless of literary form, and other students ignorant of scientific method.

It may be suggested that the Universities might expand and improve their general tests, so as to make them correspond with the education, both literary and scientific, which a student,

matriculating at the age of nineteen years, should be expected to have acquired ; and that they should themselves make provision, in cases where this test is not satisfied, for ensuring the completion of the general preliminary education of their students, before close specialisation is allowed.

In particular, it appears desirable that some means should be found for giving a wider range of attainment to students preparing for the profession of teaching. The result of the existing system is usually to place the supreme control of a public school in the hands of a headmaster who has little knowledge of the scientific side of education ; while the instructors in many colleges have to deal with students who have had no training in the exact and orderly expression of their ideas.

Our main intention is not, however, to offer detailed suggestions, but to express our belief that this question of the adaptation of secondary education to modern conditions involves problems that should not be left to individual effort, or even to public legislative control ; that it is rather a subject in which the Universities of the United Kingdom might be expected to lead the way and exert their powerful influence for the benefit of the nation.

*October 1903.*

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